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THE ORIGINS OF LEYLAND'S CYPRESSES (X*CUPRESSOCYPARIS LEYANDII*) BASED ON DNA DATA

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ABSTRACT

Leyland's cypress (*xCupressocyparis leylandii*) is a putative, spontaneous hybrid between *Chamaecyparis nootkatensis and Cupressus macrocarpa.* To investigate this putative origin, twenty five Leyland's cypresses were sampled, along with living, putative parents of *Ch. nootkatensis* and *Cup. macrocarpa* from gardens in the UK. The DNA was extracted and analyzed by DNA fingerprinting (RAPDs) and Inter-Simple Sequence Repeats (ISSRs). DNA fingerprinting indicated that Leyland's cypresses were intermediate between the putative parental species. When a total of 77 RAPD bands were examined by principal coordinates analysis, the Leyland's cypresses were ordinated in an intermediate position between *Ch. nootkatensis* and *Cup. macrocarpa,* suggestive of hybrid origin. Several additive bands between 'Aurea' (*Ch. nootkatensis*) and 'Lutea' (*Cup. macrocarpa*) were found in Leyland's cypresses. Neither the sequences of nrDNA (nuclear ribosomal ITS region) nor chalcone synthase were informative due to heterozygosity in both the parents, and the putative hybrids. Examination of Inter-Simple Sequence Repeats (ISSR) by capillary electrophoresis revealed Castlewellan and Galway Gold trees to be intermediate in their bands between Aurea and Lutea, suggesting hybrid origin. A recent nomenclatural moving of *Ch. nootkatensis* to *Xanthocyparis* (*X. nootkatensis*), resulted in a change of the name Leyland's cypress to *xCuprocyparis leylandii.* But, recently, Little et al. proposed restoring *Callitropsis* in place of *Xanthocyparis* and thus, *Callitropsis nootkatensis.* If accepted, this new name, *Callitropsis nootkatensis*, will lead to a new name for Leyland's cypress.

KEY WORDS: Leyland's Cypress, *xCupressocyparis leylandii*, hybrids, *Cupressus macrocarpa*, *Chamaecyparis nootkatensis*, *Xanthocyparis nootkatensis*, *Callitropsis nootkatensis*, RAPDs, ISSR.

Leyland's Cypresses (*xCupressocyparis leylandii*) are some of the most widely cultivated horticultural trees in the UK (Rushforth, 1987). Yet, the origin of such plants is a horticultural mystery. *xCupressocyparis leylandii* is a putative spontaneous hybrid between *Cupressus macrocarpa* Hartw. (Monterey Cypress) and *Chamaecyparis nootkatensis* (D. Don) Spach (Nootka cypress). However, the parentage of *xCupressocyparis leylandii* has been assigned on the basis of seed origin and the similarity of foliage, not on any specific intentional crossings, or other experimental data.

The history of the initial trees of Leyland cypress is reviewed by Owens et al. (1964), and Mitchell (1996) adds details on several more recently discovered trees. Owens et al. (1964), report that in 1888, some seeds obtained from *Ch. nootkatensis* (Nootka cypress) growing at Leighton Hall were sown and six of the plantlets raised differed in foliage from the others. Mr. C. J. Leyland (brother-in-law of Mr. Naylor of Leighton Hall), took the 6 plantlets [Note: these seedlings were unfortunately, called clones 1 to 6, but they are not actually clonal (e.g. asexually derived)] and planted these at his home at Haggerston Castle (Kew Bull. No. 3, 1926). "Clone 2" was later named 'Haggerston Grey' and is very widely planted. These six plants were later described as intergeneric hybrids, *xCupressocyparis leylandii* Dallimore.

In 1911, Mr. Leyland's nephew, Capt. J. M. Naylor, picked a cone from a *Cupressus macrocarpa* (Monterey cypress) at Leighton Hall that grew about 50 yards from a *Ch. nootkatensis* tree (Owens et al., 1964). He planted these *C. macrocarpa* seeds. When the seedlings developed adult foliage, two were unusual (different from *C. macrocarpa*). These two plants were re-planted about one-half mile apart behind Leighton Hall and these plants became known as 'Leighton Green' ("clone 10") and 'Naylor's blue' ("clone 11"). In 1940, seed was collected from a Monterey cypress and two plantlets with

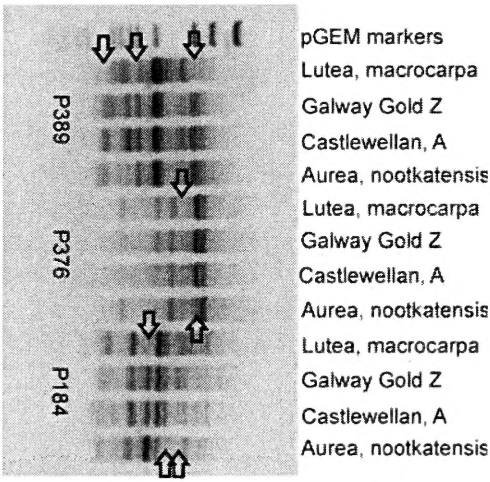

Figure 1. RAPDs gel showing complementary bands between putative parents (Lutea and Aurea) and in putative hybrids.

unusual foliage were raised as "clone 20" and "clone 21". The cultivar 'Castlewellan' was derived from a seed from a cone on a fallen branch of Monterey cypress 'Lutea', growing near a slightly yellow foliaged Nootka cypress, 'Aurea'. The cultivars 'Harlequin', 'Golconda' and 'Silver Dust' are reported to have arisen as sports on older clones (cultivars). Other clones (cultivars) have no recorded history: 'Clun Rectory', 'Galway Gold', 'Hyde Hall' and 'Rostrevor'.

Leyland's cypresses were recognized as hybrids as *Cupressus x leylandii* Jackson & Dallimore (Kew Bull. #3, 1926). Later, when the genus was divided into *Chamaecyparis* and *Cupressus*, the present name was applied (*xCupressocyparis* Dallimore).

The analysis of DNA-genetic variation within and among populations and among species has been developed in our lab for the *Cupressaceae* (Adams and Turuspekov, 1998; Adams, 1999, 2000a, 2000b, 2000c, 2000d; Adams, 2001; Adams et al., 2001a, 2001b). DNA fingerprinting, RAPD (Random Amplified Polymorphic DNAs)

	P398			P376		P184		
Arw	1	2	3	1	2	1	2	3
M	-	-	-	+	-	+	+	-
Z	+	+	+	+	+	+	+	+
A	+	+	+	+	+	+	+	+
N	+	+	+	-	+	-	-	+

Table 1. Bands showing complementary inheritance for three primers in figure 1. Arw = Arrow; M= *Cup. macrocarpa*, 'Lutea'; Z = 'Galway Gold', A = 'Castlewellan'; N = *Ch. nootkatensis*, 'Aurea'.

and ISSR Inter-Simple-Sequence-Repeats) are ideally suited for the identification of clones and resolving the question of parentage.

The purpose of this paper is to attempt to resolve the historical and genetic relationships among clones of Leyland's Cypresses and their putative parents and to provide identification of the individuals and their parentage by DNA fingerprinting and DNA sequencing.

MATERIALS AND METHODS

In addition to the samples of Leyland's cypress (appendix 1), samples were collected from the living putative parents, *C. macrocarpa* (3) and *Ch. nootkatensis* (2), from gardens in the United Kingdom to use as putative parents in the analysis. Although both species are endemic to the west coast of North America, it seemed appropriate to select from cultivated trees in the United Kingdom as that is the place of origin of Leyland's cypresses.

One (1) gram (fresh weight) of the foliage was placed in 20 grams of activated silica gel and transported to the lab, where it was stored at -20° C until the DNA was extracted by use of the Qiagen DNeasy mini plant kit.

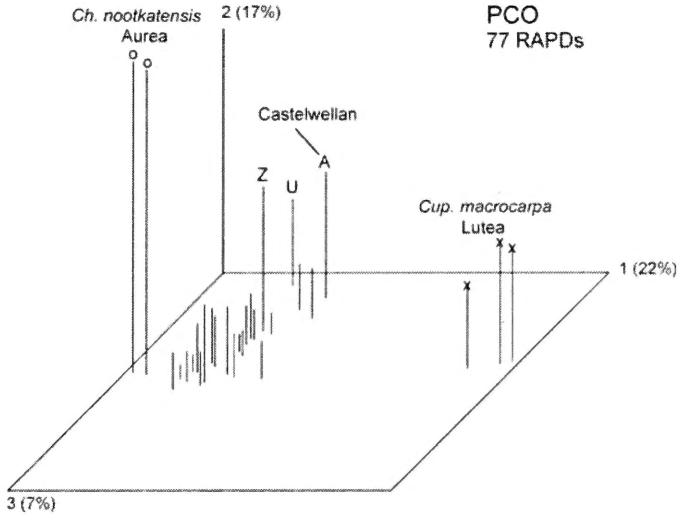

Figure 2. PCO ordination based on 77 RAPD bands. A = Castlewellan A, Z = Galway Gold, U ='Ferndale'.

The RAPD analysis follows that of Adams and Demeke (1993). Ten-mer primers (University of British Colombia and IDT, Inc.): (5'-3') 131: GAA ACA GCG T; 184: CAA ACG GCA C; 212: GCT GCG TGA C; 218: CTC AGC CCA G; 239: CTG AAG CGG A; 244: CAG CCA ACC G; 268: AGG CCG CTT A; 338: CTG TGG CGG T; 376: CAG GAC ATC G; 389: CGC CCG CAG T; 413: GAG GCG GCG A were used.

For RAPDs, PCR was performed in a volume of 15 μl containing 1.5 μl Promega 10X buffer, 0.2 mM of each dNTPs, 0.36 μM primers, 0.3 ng genomic DNA, 15 ng BSA and 0.6 unit of Taq DNA polymerase (Promega). A control PCR tube containing all components, but no genomic DNA, was run with each primer to check for contamination. DNA amplification was performed in an MJ Programmable Thermal Cycler (MJ Research, Inc.). RAPDs were run as: 94°C (1.5 min) for initial strand separation, then 40 cycles of 40°C (2 min), 72°C (2 min),

91°C (1 min). Two additional steps were used: 40°C (2 min) and 72°C (5 min) for final extension. Amplification products were analyzed by electrophoresis on 1.5 % agarose gels, 75V, 55 min, and detected by staining with ethidium bromide. The gels were photographed under UV light with Polaroid film 667.

Inter-Simple Sequence Repeat (ISSR) analysis follows Adams et al. (2003) and utilized ISSR primer UBC-811: GAGAGAGAGAGAGAGAC and the RAPD protocol (above) except using an annealing temperature of 50°C in the PCR amplification. The resulting reactions were then analyzed by adding 1 μl of product plus 1 μl of 400 bp size standard to the CEQ sample loading solution and running the samples on the Beckman CEQ 8000 capillary instrument at 6 kv for 60 min.

Numerical analysis follows Adams' (1975) minimum spanning networks and Gower's (1966) formulation of principal coordinate ordination.

RESULTS AND DISCUSSION

Figure 1 shows RAPD bands for the putative parents ('Lutea', *Cup. macrocarpa*; 'Aurea', *Ch. nootkatensis*) and the putative hybrids, Castlewellan A and Galway Gold, Z. Notice for primer 389, there are three bands that show inheritance. For primer 376, there are two bands that are complementary and for primer 184 there are three complementary bands. This can be seen more diagrammatically in Table 1.

So in five cases, parental bands came from *Ch. nootkatensis* ('Aurea') and in three cases parental bands came from *Cup. macrocarpa* ('Lutea'). This is perhaps the strongest evidence to date that 'Aurea' and 'Lutea' are the parents of 'Castlewellan' (although this does not exclude other *Ch. nootkatensis* growing in the area). 'Galway Gold' also appears to be a hybrid but it is also a distinct cultivar from 'Castlewellan'.

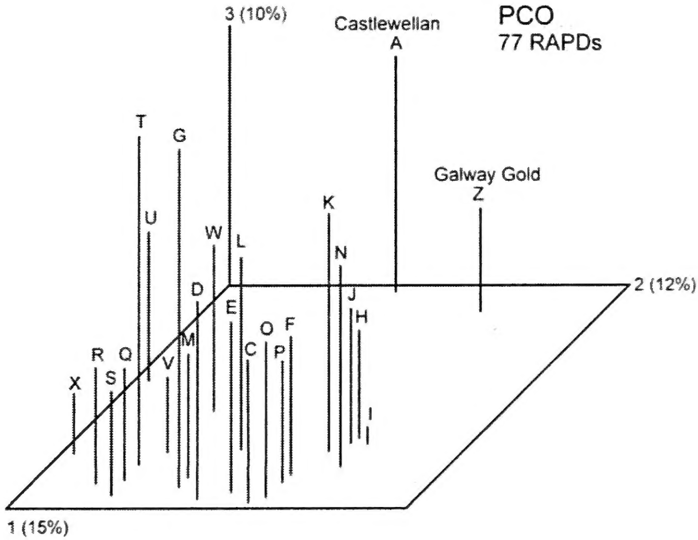

Figure 3. PCO of Leyland's cypresses (with *Ch. nootkatensis* and *Cup. macrocarpa* removed).

Considering all 77 RAPD bands, PCO ordination shows the parental species well resolved (fig. 2) and the Leyland's cypresses somewhat intermediate between *Ch. nootkatensis* and *C. macrocarpa* (fig. 2). Note particularly trees 'Castlewellan' (A) and Galway Gold (Z) are intermediate between the putative parents ('Aurea' and 'Lutea', fig. 2). 'Ferndale' (U) appears to be very similar to 'Castlewellan' and 'Galway Gold' in this PCO. The balance of the Leyland's cypresses show a general clustered that suggests they had a different parentage(s) from 'Castlewellan' and 'Galway Gold' cultivars.

In order to examine the relationships between Leyland's cypresses clones more closely, PCO was performed without the putative parents. Several smaller clusters are visible (fig. 3) suggesting that 'families' of Leyland's cypresses came from cones of a single tree (ex. [X, R, S, Q]; [E, C, O, P, F]; [K, N, J, H]).

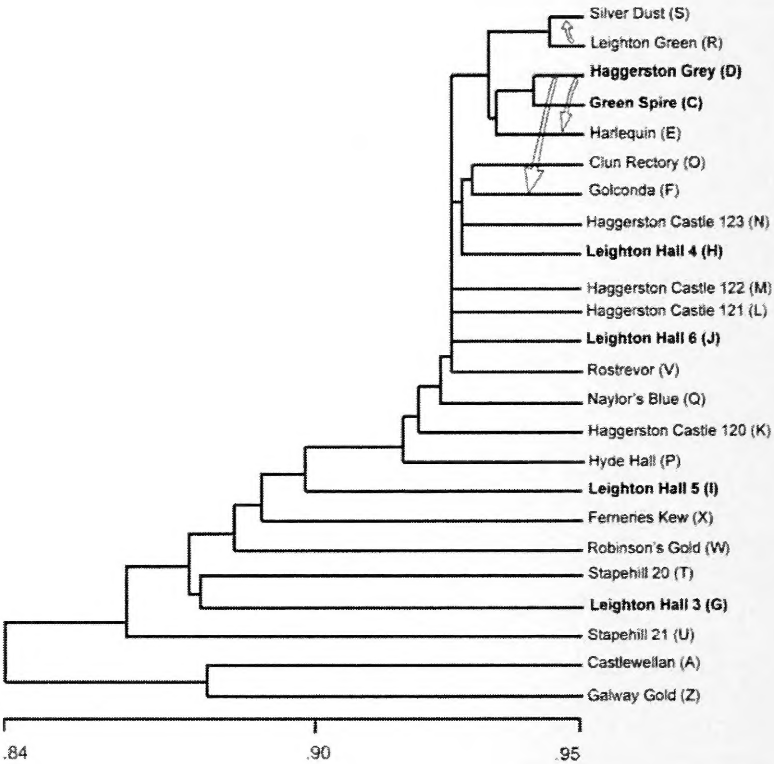

Figure 4. Minimum spanning network based on 77 RAPDs. Arrows show the putative origins of 3 clones.

Some Leyland's cypresses are thought to be clones from previous Leyland's cypresses [e.g., 'Silver Dust' (S) from 'Leighton Green'(R)] and these do cluster together in figure 3. To examine these kinds of differences, a minimum spanning network was produced (figure 4). Notice that 'Silver Dust' (S), a branch sport cloned from 'Leighton Green' (R) at Washington, D.C. is nearly identical to 'Leighton Green'. Likewise, 'Harlequin' (E), having white patches on the foliage, reputedly a branch sport obtained 'Haggerston Grey' (D), is nearly identical to 'Haggerston Grey' (D). However, 'Golconda' (F), with

uniform pale golden green foliage, another reputed branch sport from 'Haggerston Grey' (D), is actually more similar to 'Clun Rectory' (O). This indicates that 'Golconda' is probably not a sport from 'Haggerston Grey', but perhaps from 'Clun Rectory'.

In general, one can see (fig. 4), that from 'Silver Dust' to 'Hyde Hall', these Leyland's cypresses are very genetically similar. The six individuals obtained as seedlings from *Ch. nootkatensis* cones at Leighton Green (1888) are in boldface (Fig. 4). By the diversity of their DNA, it seems unlikely that these seedlings were half sibs (i.e., had the same mother tree). 'Castlewellan' and 'Galway Gold' are rather distinct, as is 'Stapehill' to a lesser degree. The Kyloe Woods clones, numbers 120 (K), 121 (L), 122 (M) and 123 (N), have been recorded as very early cuttings from the original 1888 seedlings, at least as far as three of the clones are concerned (Mitchell, 1996). Figure 4 shows that clones 121 (L) and 122 (M) are similar to the un-named original seedling 'clone' 6 and that clone 123 (N) is very similar to un-named original seedling 'clone' 4. However, the analysis shows that clone 120 (K) (as represented in the stock bed at Alice Holt) is different. This suggests that it is of independent origin.

'Rostrevoer' (V) (as represented in the stock bed at Alice Holt) is shown to be very similar to the un-named seedling 'clone' 6. There are two possible explanations. The stock bed labels could have become switched at some stage, with the result that the plant recorded as 'Rostrevor' and the clone 120 (K) have been switched. This would be consistent with Mitchell's assertion (1996) that three of the Kyloe Wood trees were recorded as cuttings from one original seedling plant. The other possibility is that Rostrevor Garden received one of the early cuttings distributed before the hybrid was suspected (Mitchell, 1996), and thus received a cutting of 'clone' 6.

Adams et al. (2003) found that ISSRs were useful in delimiting closely related *Juniperus* species. So, in addition to RAPDs analyses, a preliminary ISSR analysis was made using 'Aurea', 'Lutea' and 'Castlewellan' (A) and 'Galway Gold' (Z). Figure 5 shows the capillary electrophoresis chromatograms for these samples and one can see several peaks (bands) that are complementary (arising from

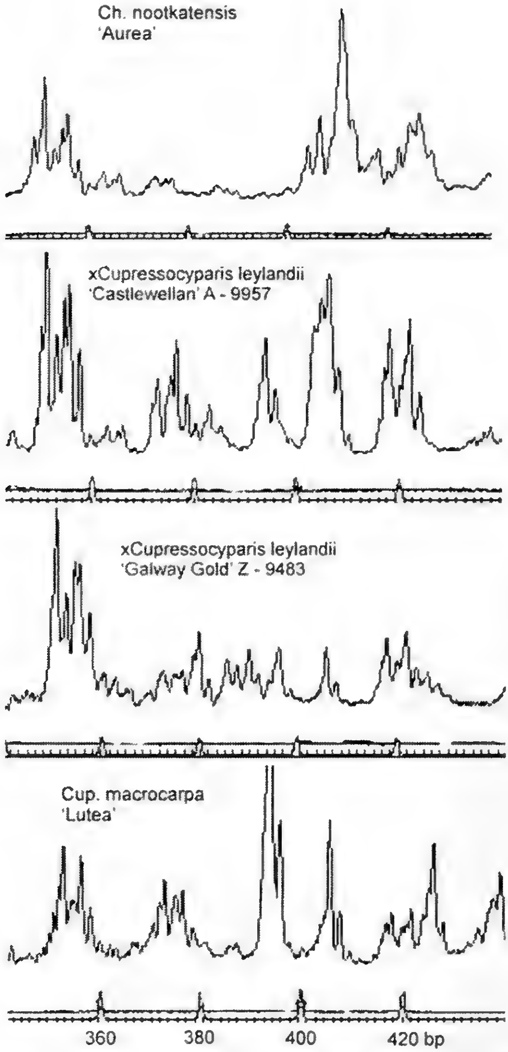

Figure 5. ISSR capillary electrophoresis (partial, ~300 - 440 bp).

either one of the putative parents), just as seen with the RAPDs data (Fig. 1). Note especially the peaks (bands) around 380 bp that are present in 'Lutea', absent in 'Aurea', but present in 'Castlewellan' (A) and 'Galway Gold' (Z). Also peaks around 450 bp in 'Aurea', are absent in 'Lutea', but present in 'Castlewellan' (A) and 'Galway Gold' (Z). The complementary inheritance of RAPD bands is well known (Adams and Demeke, 1993). This is strong evidence that Leyland's cypress is of hybrid origin from the putative parental species.

CONCLUSIONS

The long standing hypothesis that Leyland's cypresses arose by chance crossing of *Chamaecyparis nootkatensis* and *Cupressus macrocarpa*, cultivated in the United Kingdom, seems to be verified by the DNA fingerprinting presented in this study. It is unfortunate that both DNA sequences examined (nrDNA, chalcone synthase) were too polymorphic in the parents to be utilized. However, this study should aid nurserymen and horticulturalists in applying names to Leyland's cypresses of commercial utilization.

The Nootka cypress (*Chamaecyparis nootkatensis*) is of uncertain generic origin at present. Originally named *Cupressus nootkatensis* D. Don, it was transferred by Spach to his new genus *Chamaecyparis*, as *Chamaecyparis nootkatensis* (D. Don) Spach, and more recently by Farjon et al. (2002) to *Xanthocyparis nootkatensis* (D. Don) Farjon & Harder. Gadek et al. (2000) found *Chamaecyparis nootkatensis* to be within *Cupressus* (of the Old World) in their study, but Little et al. (2004), using more extensive DNA sequence data, found it to be congeneric with *Xanthocyparis vietnamensis*; in addition, they presented evidence from DNA sequencing that *Cupressus macrocarpa* (Monterey Cypress) (and the New World cypresses) may not be in the same genus as the Old World cypresses, such as the type species of *Cupressus, C. sempervirens* L.

The recent nomenclatural change (Farjon, et al., 2002) moving *Chamaecyparis nootkatensis* to *Xanthocyparis* (*X. nootkatensis* (D. Don) Farjon), resulted in a change of the name (Leyland's cypress) to *xCuprocyparis leylandii* (A.B. Jackson & Dallimore) Farjon.

However, Little et al. (2004) pointed out that the genus *Callitropsis* and the name *Callitropsis nootkatensis* (D. Don) Orsted has priority and proposed restoring *Callitropsis* in place of *Xanthocyparis* (thus *Callitropsis nootkatensis*). If accepted, this name, *Callitropsis nootkatensis*, will lead to new scientific name for Leyland's cypress.

ACKNOWLEDGMENTS

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x ***Cupressocyparis leylandii*** :
9463-9468. In 1888, seed was collected from *Ch. nootkatensis* at Leighton Hall and germinated. Six seedlings were unusual and sent to Haggerston Castle in 1892; samples 9463-9468 are from these 6 trees.
9463, C, Clone 1, 'Green Spire'
9464, D, Clone 2, 'Haggerston Grey'
9465, G, Clone 3, un-named
9466, H, Clone 4, un-named
9467, I, Clone 5, un-named
9468, J, Clone 6, un-named
9469-9470. In 1911, two unusual seedlings were obtained from seed from *Cup. macrocarpa* at Leighton Hall, UK. The two samples from these trees are:
9469, Q, Clone 10, 'Naylor's Blue'
9470, R, Clone 11, 'Leighton Green'.
9471-9472. Plants, reputed cuttings from the early seedlings planted at Kyloe Wood, Haggerston Castle (Mitchell (1972) records three as planted in 1897 and one in 1906):
9471, K, Clone 120, un-named
9472, L, Clone 121, un-named
9473, M, Clone 122, un-named
9474, N, Clone 123, un-named
9475-9476. In 1940, seed from *Cup. macrocarpa* at Barthelemy's Nursery at Stapehill were germinated and two unusual individuals were found. No *Ch. nootkatensis* was recorded in the vicinity:
9475, T, Clone 20, un-named
9476, U, Clone 21, 'Stapehill'.
9477, V, 'Rostrevor', reported to have originated from an old tree at Rostrevor, County Down, Ireland, planted circa 1870, which blew down before 1914, but Mitchell (1996, p. 64) indicates that the plants in cultivation are from cuttings made much later.
9478, O, 'Clun Rectory', a tree growing at Clun, Shropshire, UK circa 1900.
9479, S, 'Silver Dust', a branch sport obtained from Clone 11 'Leighton Green' tree (=**9470**, R, above) growing in Washington, D. C. Date uncertain.
9480-9481, branch sports with patches reputedly obtained from clone 2 'Haggerston Grey'(9464, D, above):

9480, E, 'Harlequin', Weston Park, Shropshire. Harlequin has patches of white foliage.
9481, F, 'Golconda', Wyborton, Bedfordshire. Golconda has pale golden, green foliage.
9482, Z, 'Galway Gold', origin unknown but often thought to be a renaming of 'Castlewellan'.
9483 B, 'Castlewellan', Castlewellan, County Down, Northern Ireland, 1962.
9484, W, 'Robinson's Gold', County Down, Ireland, 1964.
9485, X, 'Ferneries Kew' tree found growing in the Fernery at Kew Gardens, UK, date unknown.
9486, P, 'Hyde Hall', tree growing at Hyde Hall, Essex, date unknown.
Material collected by Michael Lear from trees at Castlewellan Arboretum, County Down, Northern Ireland:
9957, A, 'Castlewellan', Castlewellan, UK, from the original tree, reputedly from a cone from *Cup. macrocarpa* 'Lutea' growing near a *Ch. nootkatensis* 'Aurea'. 1962.
Chamaecyparis nootkatensis
9956, N1, 'Aurea', tag 0177, Castlewellan, UK. planted in 1892.
10069, N2, Westernbrit, UK, planting date unknown.
Cupressus macrocarpa
9953, M1, 'Lutea', tag 0045, Castlewellan, UK, planting date unknown
9954, M2, tag 0051, Castlewellan, UK, planting date unknown.
9955, M3, Tregrehan, UK, planted in early 1800s.

Appendix 1. Leyland's cypresses, *Ch. nootkatensis* and *Cup. macrocarpa* collected for analysis, with notes on their origins. Four digit numbers refer to Adams' Lab analyses numbers. The letters (A, B, C..) refer to labels in figures. Clone numbers are those of Owens et al. (1964).

COMPETITION BETWEEN *HELIANTHUS PARADOXUS* (ASTERACEAE) AND *DISTICHLIS SPICATA* (POACEAE)

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ABSTRACT

Helianthus paradoxus (Asteraceae) is a threatened annual species found in a few inland salt marshes in west Texas and New Mexico. It is a diploid hybrid species, found on saline soils where its progenitors are absent. Intraspecific competition of *H. paradoxus* was examined at various densities to determine the density at which competition occurs. In addition, the effect of soil salinity on the growth and competition between *H. paradoxus* and *Distichlis spicata* (Poaceae), a potential salt marsh competitor, was examined in greenhouse experiments. These experiments were conducted to determine the role of competition in allowing *H. paradoxus* to establish in inland salt marshes. In the intraspecific competition experiment, total dry mass of *H. paradoxus* was approximately 10 g/pot and did not change with densities from 1-16 plants/pot. Dry mass per plant of all factors measured (except flowers, which were not produced in the experiment) decreased significantly as density increased from 1 to 4 or 8 plants/pot and then remained constant to 16 plants/pot. *Distichlis spicata* was a poor competitor at both soil salinities tested and in all of the proportions of the two species tested. Results suggest that *H. paradoxus* could establish in salt marshes in the presence or absence of *D. spicata*. The ability of *H. paradoxus* to out-compete *D. spicata* at high or low salt levels indicates that gaps or disturbances in *D. spicata* vegetation would not be necessary to allow the establishment and persistence of *H. paradoxus* in the salt marsh environment.

KEY WORDS: Asteraceae, Compositae, competition, *Distichlis, Helianthus*, inland salt marsh, Poaceae, sunflowers, saltgrass.

INTRODUCTION

The genus *Helianthus* consists of approximately 67 species of annual and perennial herbs made taxonomically difficult by hybridization among its members (Correll and Johnston 1979). The genus has been divided into four sections (Heiser 1965). *Helianthus paradoxus* and its parent species, *H. annuus* and *H. petiolaris*, are annuals belonging to the same section, are obligate out-crossers, and have the same chromosome number (n=17). In spite of these similarities, phenological, morphological, and habitat characteristics are different making identification relatively easy. *Helianthus annuus* and *H. petiolaris* flower in the spring and summer (depending on location), while *H. paradoxus* flowers in October.

Morphologically, *H. paradoxus* is distinguished from the parent species by having smaller heads, nearly glabrous stems, longer and narrower leaves, narrower phyllaries, and fewer ray flowers (Heiser 1958; Correll and Johnston 1979). *Helianthus annuus* occurs throughout North America on disturbed, heavy soils. *Helianthus petiolaris* occurs in western North America on sandy soil. *Helianthus paradoxus* is found in west Texas and New Mexico on brackish, saline, marsh soils (McDonald 1999).

Hybridization between two common sunflowers (*Helianthus annuus* and *H. petiolaris*) resulted in the production of a hybrid species, *H. paradoxus*. *Helianthus paradoxus* is an annual species based on distinct morphological characteristics (Correll and Johnston 1979), that was first described in 1958 (Heiser 1958; Heiser 1965). F_1 hybrids between *H. paradoxus* and its progenitors are largely sterile with low pollen stainability (low viability) and seed set (Heiser 1958; Heiser 1965; Heiser et al. 1969). Also, *H. paradoxus* has a stable karyotype and expresses no meiotic abnormalities (Chandler et al. 1986), and has a much larger genome than either of its parent species (Sims and Price 1985). *Helianthus paradoxus* has combined rDNA repeat types of *H. annuus* and *H. petiolaris*, and has the chloroplast genome of *H. annuus*, confirming that it arose through hybridization (Rieseberg et al. 1990; Welch and Rieseberg 2002; Lexer et al. 2003).

It has been estimated that the hybridization event that created *H. paradoxus* occurred between 75,000 and 208,000 years ago (Welch and Rieseberg 2002). For interspecific hybridization to be successful, some of the resulting offspring must survive and be fertile (Abbott 2003). In addition, the fertile hybrid must be isolated reproductively. It has been shown that *H. paradoxus* is a very poor competitor when grown with *H. annuus* in conditions similar to the habitat favored by *H. annuus* (Bush and Van Auken 2004; Van Auken and Bush 2004). If hybrids are adapted to a habitat different from that of either of the parents, hybrids could be spatially isolated from the parents and avoid any minority type disadvantages and possible negative effects of interspecific competition from its progenitors. *Helianthus paradoxus* is genetically isolated from its parents, and was able to become established and persist in a habitat different from that of either of its parents. This species is endemic to inland sulfate dominated salt marshes (McDonald 1999). Hybridization resulted in recombinants with genes and traits producing extreme phenotypes and plants that could occupy an extreme habitat compared to the parental species (Rieseberg et al. 2003). Thus, hybridization resulted in genetic recombinants that could occupy an extreme habitat.

It has been shown that *H. paradoxus* is more salt tolerant than *H. annuus* (Mendez 2001; Welch and Rieseberg 2002), and *H. paradoxus* does produce more biomass and is a better competitor when grown with *H. annuus* or *H. petiolaris* at high salt levels (Bush and Van Auken 2004; Van Auken and Bush 2004). Although experiments indicate that *H. paradoxus* can out-compete its progenitors in the extreme salt marsh environment, in order for this hybrid to persist, it must be able to compete with other established habitat competitors in an extreme habitat. *Helianthus paradoxus* has been reported to grow with *Distichlis spicata* (saltgrass) in two west Texas counties (Pecos and Reeves), two eastern New Mexico counties in the Pecos River watershed (Chaves and Guadalupe), and two western New Mexico counties in the Rio Grande watershed (Cibola and Valencia).

The largest population of *H. paradoxus* is reported from a salt marsh at the Diamond-Y Spring Preserve near Ft. Stockton, Texas (McDonald 1999). Within this marsh, there is a gradient of abiotic characteristics and vegetation as one moves from the lowest elevation in the marsh to the

upland. The change in elevation is only 1 m over a distance of between 50 and 150 m, depending on location. However, soil salinity is normally lower and soil water content higher in the drainage of the marsh, with soil salinity increasing and soil water content decreasing as one moves upland (Van Auken and Bush 1998). Immediately adjacent to the drainage in the wettest part of the marsh, *Scirpus americanus* (bulrush) is the dominant species. Moving slightly upland, populations of *H. paradoxus* can be found growing with *D. spicata,* in areas where soil salinity and soil water content are intermediate (Van Auken and Bush 1998). Further upland, the grass *Sporobolus airoides* (alkali sacaton) dominates in some areas. In similar areas, *Prosopis glandulosa* (honey mesquite) is a dominant. Finally in the driest environments, *Larrea tridentata* (creosote bush) a common Chihuahuan Desert species is dominant (Hart 2002).

The abilities of *H. paradoxus* to compete with *D. spicata* are unknown. It has been shown that the presence of neighbors reduces the growth of *H. paradoxus*, while disturbances promote its growth (Bush and Van Auken 1997; Van Auken and Bush 2004). Thus, competition from neighbors could play a very important role in the establishment, ecology and management of this threatened species. Competition between plants has been studied extensively, and appears to be one of the central forces shaping the structure of plant communities (Grace and Tilman 1990). Moreover, competition is suggested to be one of the driving forces leading to temporal changes in community composition during plant succession (Bazzaz 1990). The interaction between species during succession may be competitive, neutral, or facultative (Connell and Slatyer 1977), but rarely seems to be one type. In addition, the nature of the interaction probably changes as abiotic conditions are altered.

One of the purposes of the studies presented here was to examine the intraspecific competitive abilities of *H. paradoxus* in order to determine appropriate densities to be used in the interspecific competition experiment. Secondly, the interspecific competition ability of *H. paradoxus* and *D. spicata*, a grass and a potential major environmental competitor, were examined under different soil salinity levels. We hypothesized that these two species would be equal competitors with one another, based on their co-dominance within the marsh.

METHODS

Seeds of *H. paradoxus* were collected from native plants located north of Ft. Stockton, Texas in Pecos County (31° 0.54' N, 102° 55.49' W). Seeds were placed on wet paper toweling in 5 cm deep trays covered with plastic wrap and placed at 4° C for three weeks to break dormancy. Deionized water was added as needed to keep the toweling moist. Clumps of *D. spicata* (saltgrass) were collected from the salt marsh at the Diamond-Y Spring Preserve near Fort Stockton, Texas. Clumps were approximately 15 x 15 x 15 cm and were collected by extraction with a shovel and placed in large plastic bags for transport to the greenhouse in preparation for the experiment. Clumps were kept in open-top plastic tubs with several centimeters of water at the bottom in the greenhouse for approximately one week prior to removal of the *D. spicata* rhizomes. Deionized water was added as needed to keep the soil wet. Rhizomes were carefully removed from the soil by washing. Live rhizomes were cut into 3-cm lengths and placed in tap water and then randomly selected for transplanting. Aboveground parts and roots were trimmed to 5-cm lengths prior to transplantation.

Seedlings and saltgrass rhizomes were transplanted into pots containing 1,400 g of Patrick series soil described as clayey-over-sandy, carbonatic-thermic, typic calciustoll, with the A horizon varying in depth from 25 to 41 cm (Taylor et al. 1966). This soil was chosen because it is friable and allows for harvesting of roots. Other experiments have shown that it supports the growth of the species used in this experiment. The soil was air-dried and sieved (6.4 mm mesh) prior to placement into pots lined with plastic bags (to prevent nutrient, salt and water loss). Soil analysis indicated 7.5 g/kg carbon, 11.6 g/kg calcium, 1.3 g/kg magnesium, 1.0 mg/kg total nitrogen, 12 mg/kg phosphorus, 138 mg/kg potassium, and 196 mg/kg sulfur. Because of the low nutrients in the soil, each pot was supplemented with 0.2 g N as NH_4NO_3, 0.15 g P as Na_2HPO_4, 0.1 g K as KCl, and 0.04 g S as $MgSO_4$.

A fiberglass greenhouse was used for plant growth with photosynthetically active photon flux density (PPFD, 400-700 nm) at 37% $\pm$ 12% of the outside mean PPFD (1,542 $\pm$ 18 μmol/m^2/sec $\pm$ SD

averaged over the experiment). Light level was measured with a LI-COR® LI-188 integrating quantum sensor.

Intraspecific competition—Effects of intraspecific competition were examined for *H. paradoxus* at densities of 1, 2, 4, 8, and 16 plants/pot (van den Bergh 1968). Plants were grown for 88 days after which flower, leaf, stem, aboveground (= flower + stem + leaf dry mass), belowground, and total dry mass were determined by drying at 100° C to a constant mass. Ash-free belowground dry mass (Bohm 1979) was measured by carefully washing the soil from the roots, drying to a constant mass at 100° C, weighing, ashing at 650° C for 3 h, reweighing, and subtracting the inorganic components. Mean dry mass per plant was determined by dividing the total mass by the density. There were five replications of each treatment.

Analyses of variance (ANOVAs) were completed for each per pot and per plant measure (leaf, stem, aboveground, belowground, and total dry mass) with density (1, 2, 4, 8, and 16) as the main effect. No flowers were produced, therefore no analysis of flower dry mass was conducted. The Scheffé Multiple Comparison Test was used to detected differences between the density treatments (SAS 1990).

Interspecific Competition—Total density in each pot in the *H. paradoxus-D. spicata* competition experiment was six plants, either six individuals of one species for growth in monoculture or proportions of *Distichlis:Helianthus* of 4:2, 3:3, or 2:4 for the species in mixture (van den Bergh 1968; Harper 1977). For the salinity treatment in this experiment, 5 g/kg NaCl was added to each pot. Twelve weeks after initiation of the experiment and after growth had stopped, plant tops were harvested by clipping at the soil surface, separating by species, and determining dry mass by drying at 100° C to a constant mass. As previously described, ash-free belowground dry mass (Bohm 1979) was measured. Total mean dry mass per plant was determined by adding the aboveground and belowground dry mass and dividing the total mass by the density. There were five replications of each treatment.

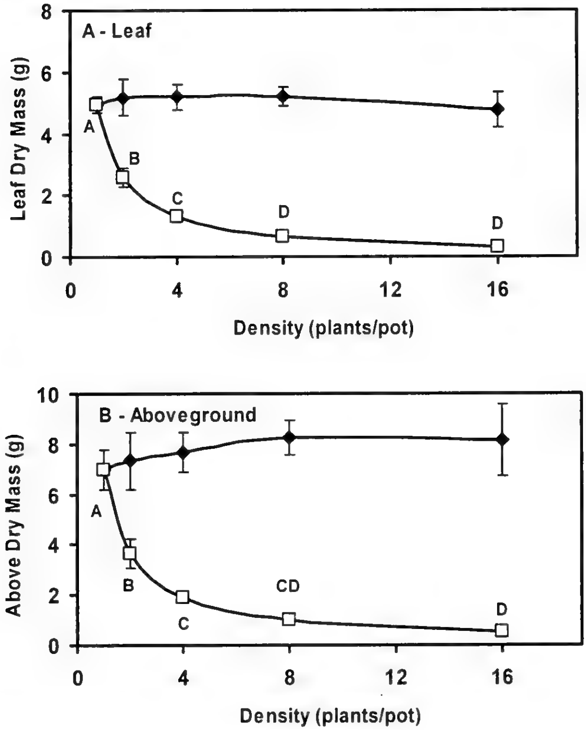

Figure 1—*Helianthus paradoxus* leaf (A) and aboveground dry mass (B) per pot (■) and dry mass per plant (□) as a function of density. There were no significant differences between any of the per pot measurements ($P > 0.05$, Scheffé Multiple Comparison Test). For per plant measures, symbols with the same letter are not significantly different ($P > 0.05$, Scheffé Multiple Comparison Test). Error bars represent one standard deviation.

ANOVA were performed separately for each species to test the effects of soil salinity (with and without NaCl) and proportion (*D. spicata:H. paradoxus*, 6:0, 4:2, 3:3, 4:2, and 0:6 plants/pot) on total dry mass per plant (SAS 1990). Main effects and their interactions were entered into the statistical model.

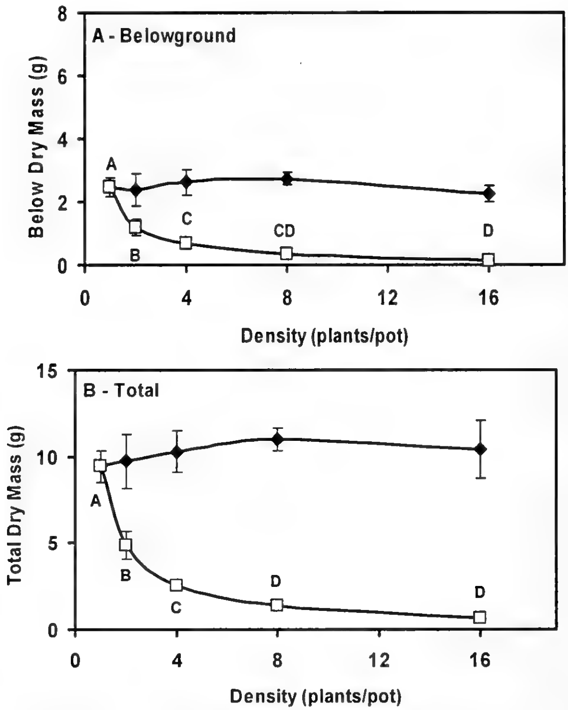

Figure 2—*Helianthus paradoxus* belowground (A) and total dry mass (B) per pot (■) and dry mass per plant (□) as a function of density. There were no significant differences between any of the per pot measurements ($P > 0.05$, Scheffé Multiple Comparison Test). For per plant measures, symbols with the same letter are not significantly different ($P > 0.05$, Scheffé Multiple Comparison Test). Error bars represent one standard deviation.

RESULTS

Intraspecific competition—For the intraspecific competition experiment, no flowers were produced, therefore flower dry mass per plant and per pot were zero for all densities (data not shown). Leaf, aboveground, belowground, and total dry mass per pot remained relatively constant over the range of densities tested and there were no significant differences among the densities (Fig. 1 and Fig. 2; One-way ANOVA; $P > 0.05$, Scheffé Multiple Comparison Test). Leaf dry mass per plant decreased with increasing densities. The leaf dry mass per

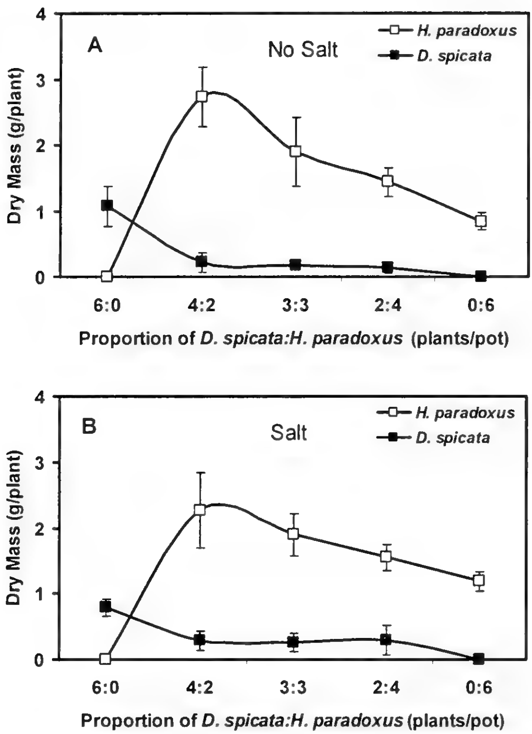

Figure 3—Dry mass (g/plant) of *Distichlis spicata* (■) and *Helianthus paradoxus* (□) without the addition of sodium chloride (A) to the soil and with the addition of sodium chloride to the soil (B). For *D. spicata*, mixture dry masses (proportions of 4:2, 3:3, and 2:4 plants/pot) were significantly lower than dry mass in monoculture (proportion of 6:0); while for *H. paradoxus*, mixture dry masses were significantly greater than dry mass in monoculture (proportion of 0:6 plants/pot).

plant at densities of 1, 2 and 4 plants/pot were significantly different from each other and from all others, while at densities of 8 and 16 plants/pot, leaf dry masses were not significantly different from one another, but were significantly lower than all other densities tested (Fig. 1a; One-way ANOVA; $P \leq 0.05$, Scheffé Multiple Comparison Test).

Source	df	*Helianthus paradoxus* SS	*Helianthus paradoxus* F	*Distichlis spicata* SS	*Distichlis spicata* F
Proportion	1	11.3060	87.784**	3.0773	65.944**
Salt	1	0.0003	0.002	0.0002	0.006
Proportion x Salt	1	0.7733	6.005*	0.2337	5.071*
Error	36	4.5078		1.6700	
Total	39	16.5874	31.162**	4.9812	23.673**

Table 1. Effect of proportion, salt treatment, and their interaction on the dry mass per plant of *Helianthus paradoxus* or *Distichlis spicata.* For the ANOVA of each species, there were four levels of proportion, the monoculture treatments (*D. spicata:H. paradoxus;* 6:0 or 0:6) and the mixture treatments (4:2, 3:3, and 2:4) and two levels of salt (with and without NaCl). * = $P < 0.05$; ** = $P < 0.0001$

Aboveground dry mass per plant (leaves and stems) and belowground dry mass per plant also decreased with increasing density (Fig. 1b and 2a). Both aboveground (Fig. 1b) and belowground (Fig. 2a) dry mass per plant at densities of 1 and 2 plants/pot were significantly different from all others, while there were no significant differences between aboveground and belowground dry mass per plant at densities of 4 and 8 plants/pot. There were also no significant differences between densities of 8 and 16 plants/pot (Fig. 1b and Fig 2a; Scheffé Multiple Comparison Test).

Total dry mass per plant also decreased with increasing densities. Total dry mass per plant at densities of 1, 2 and 4 plants/pot were significantly different from all others, while at densities of 8 and 16 plants/pot, total dry masses were not significantly different from one another, but were significantly lower than all other densities tested (Fig. 2b; Scheffé Multiple Comparison Test).

Interspecific competition— ANOVA of *D. spicata* dry mass per plant indicated that proportion (*D. spicata:H. paradoxus*; 6:0, 4:2, 3:3, and 2:4 plants/pot) was a significant factor in the model, as well as the interaction of proportion and soil salt treatment (Table 1). Soil salt treatment was not a significant factor by itself. Dry mass of *D. spicata* in monoculture (proportion 6:0 plants/pot) was significantly greater than dry mass in all of the mixture treatments (proportions of 4:2, 3:3, 2:4 plants/pot) regardless of salinity treatment, suggesting that interspecific competition from *H. paradoxus* was greater than intraspecific competition (Fig. 3a and b). As indicated by the significant interaction term, however, the changes in dry mass as a function of proportion were dependent on the salinity treatment. In the no salt treatment, there was a greater decrease in dry mass from monoculture (6:0 plants/pot) to the mixture treatments (4:2, 3:3, 2:3 plants/pot)(Fig. 3a) than the decrease from monoculture to mixture in the salt treatment (Fig. 3b).

ANOVA of *H. paradoxus* dry mass per plant indicated that proportion (*D. spicta:H. paradoxus*; 4:2, 3:3, 2:4 and 0:6 plants/pot) was a significant factor in the model, as well as the interaction of proportion and soil salt treatment (Table 1). Soil salt treatment was not a significant factor by itself; however, as with *D. spicata* dry mass, the effects of soil salinity on dry mass were dependent on density. Regardless of salt treatment, *H. paradoxus* total dry mass per plant increased with decreasing density of *H. paradoxus*, or with increased density of *D. spicata*, suggesting that intraspecific competition was greater than interspecific competition (Fig. 3a and b). At the higher density of *H. paradoxus* (0:6 proportion), dry mass of *H. paradoxus* was lower in the no salt treatment (Fig. 2a) compared to the salt treatment (Fig. 3b). *Helianthus paradoxus* (4:2 plants/pot) total dry mass was greater in the lowest density of *H. paradoxus*. In addition, *H. paradoxus* dry mass was highest in the no salt treatment (Fig. 3a) compared to the salt treatment (Fig. 3b) at this density.

DISCUSSION

The salt marshes in western Texas and New Mexico where *H. paradoxus* is found today (McDonald 1999) were probably very

important in the past for the establishment and maintenance of new populations of *H. paradoxus* that were genetically isolated from the parent species (Abbott 2003; Rieseberg et al. 2003). Isolation in these salt marshes allowed the original population of *H. paradoxus* to escape any minority type disadvantages and avoid interspecific competition with the parent species (Abbott 2003; Rieseberg et al. 2003). Thus, the hybrid species was able to establish in ecological isolation as a result of possessing a hybrid genotype adapted to the new habitat, the salt marsh. *Helianthus paradoxus* can produce more biomass and thus out-compete and probably exclude its parental species (*H. annuus* and *H. petiolaris*) in saline soils similar to those found in these west Texas and New Mexico salt marshes (Bush and Van Auken 2004).

In order to become isolated from its parents in this environment, not only does *H. paradoxus* have to be able to out-compete its progenitors in this environment, but also out-compete any habitat competitors. Greenhouse experiments presented here show that, *H. paradoxus* produces more biomass and out-competes *Distichlis spicata* (an environmental competitor) when both species are started together (Fig. 3). Field studies showed that neighbors including *D. spicata* reduced the growth of *H. paradoxus* in the salt marsh (Bush and Van Auken 1997) and that disturbances including neighbor-removal promote the growth of *H. paradoxus* (Van Auken and Bush 2004). However, the growth reduction measured in the field was not seen in the greenhouse studies. This apparent anomaly may be due to the size disparity of *D. spicata* in the field at the start of the experiment compared to the relative equal size of the plants in the current greenhouse study. Or, it could be due to a temporal phenomenon. In the field experiment, *H. paradoxus* was planted into an environment with *D. spicata* and other ecosystem competitors already growing. This may put *H. paradoxus* at a disadvantage because it is a C_3 plant while *D. spicata* and the marsh grasses are C_4 plants. Others have reported low competitive ability of *D. spicata* in coastal marine environments where it is also found (Bertness 1991). They suggested that *D. spicata* is an early successional species and is soon replaced by mature community species. Curiously, *H. annuus*, one of the parental species of *H. paradoxus,* seems to be an early successional or gap species where it is found. As an annual, *H. paradoxus* would seem to require gaps, or be a

better competitor compared to *D. spicata.* We report here that it is a better competitor.

Although competition has been suggested as a major force in plant community development (Grime 1979; Tilman 1988; Keddy 1989; Grace and Tilman 1990), it is a hotly and persistently debated issue (Grace 1993; Wilson 1994; Grace 1995). There does not seem to be a question about plants growing together having reduced dry mass. The major issue concerns interference especially as resources change (Harper 1977; Grace 1993; Wilson 1994; Grace 1995). Does one plant cause interference and thus growth reduction of the second, or is differential growth of the two species merely a result of their individual growth potentials under a given set of abiotic conditions? We feel we are measuring the performance of one or both species as they respond to the imposed conditions. *Distichlis spicata* may grow better than *H. paradoxus* at higher salt levels, but this may be both species' response to salt, the abiotic factor, not to interference. However, at lower salt levels such as imposed in this experiment, *H. paradoxus* seems to be able to reduce the growth of *D. spicata* and, therefore, is the better competitor at both salt levels tested.

Helianthus paradoxus, like some other halophytes, can apparently actively exclude sodium and some other mineral ions (Lexer et al. 2003), can sequester other ions (Lexer et al. 2003), and has increased leaf succulence (Welch and Rieseberg 2002). These characteristics may have led to the competitive superiority of *H. paradoxus* in slightly saline soils compared to the parent species (Bush and Van Auken 2004).

Hybrid species, such as *H. paradoxus*, are often shown to be more tolerant of harsh conditions than parental species. Salt tolerance of hybrid species relative to parental species is one way that that hybrid species may escape parental competition, and may determine the sites where hybrids colonize (Abbott 2003). *Helianthus anomalus*, another diploid hybrid of *H. annuus* and *H. petiolaris*, has also been shown to be a mosaic of parental-like and transgressive phenotypes (Schwarzbach et al. 2001). The fitness effects of the transgressive characters, however, are not known.

It has been shown that segregating hybrids commonly show traits that are extreme relative to those of their progenitors (Anderson and Stebbins 1954; Lewontin and Birch 1966; Rieseberg et al. 1999; Welch and Rieseberg 2002; Rieseberg et al. 2003). However, not all hybrids show increased salt tolerance or phenotypic plasticity. Native, exotic, and hybrid species of the genus *Carpobrotus* (Aizoceae) found in coastal plant communities throughout California, were very similar in their ability to adjust to saline environments (Weber and D'Antonio 1999). While it is evident that there is a strong relationship between endemic plant species and unusual edaphic characteristics (Kruckeberg and Rabinowitz 1985), the relative role of these species' response to the abiotic factors and competition in influencing distributions is debated.

The role of abiotic conditions in influencing plant distributions and communities has long been recognized, and the distribution of vegetation in marshes has been shown to be dependent on species' varying tolerances to physical factors (Mahall and Park 1976a; DeJong 1978; Valiela et al. 1978; Mendelssohn et al. 1981; Cooper 1982; Etherington 1984; Schat 1984; Snow and Vince 1984; Naidoo et al. 1992; Ewing 2000; Rand 2000; Vilarrubia 2000). While water has often been found to be one of the most critical factors in determining the growth and distribution of species in marshes (Mahall and Park 1976a; Mahall and Park 1976b; El-Ghani 2000; Onkware 2000; Vilarrubia 2000; Rogel et al. 2001), differential species tolerance to salinity has also been shown to contribute to broad zonation of coastal vegetation (Oosting and Billings 1942; Vince and Snow 1984; Vilarrubia 2000; Rogel et al. 2001). However, biotic and abiotic factors seem to interact to cause the distribution of species in these inland salt marshes (Bush 2006a, 2006b). Data from this study suggests that *D. spicata* does not seem to be able to prevent the establishment and growth of *H. paradoxus* in saline or non-saline soils. Based on greenhouse and limited field studies, *H. paradoxus* should be able to establish in mature stands of *D. spicata.* Once *H. paradoxus* is established in the *D. spicata* community, the grassland community structure probably changes. The changes could include reduced grass

cover, density and biomass and are probably caused by shading by the sunflowers, although this has not been conclusively demonstrated.

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THE GENUS *SENEGALIA* (FABACEAE: MIMOSOIDEAE) FROM THE NEW WORLD

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ABSTRACT

Morphological and genetic differences separating the subgenera of *Acacia s.l.* and molecular evidence that the genus *Acacia* s.l. is polyphyletic necessitate transfer of the following New World taxa from *Acacia* subgenus *Aculeiferum* Vassal to *Senegalia*, resulting in fifty-one new combinations in the genus *Senegalia*: *Senegalia alemquerensis* (Huber) Seigler & Ebinger, *Senegalia altiscandens* (Ducke) Seigler & Ebinger, *Senegalia amazonica* (Benth.) Seigler & Ebinger, *Senegalia bahiensis* (Benth.) Seigler & Ebinger, *Senegalia bonariensis* (Gillies ex Hook. & Arn.) Seigler & Ebinger, *Senegalia catharinensis* (Burkart) Seigler & Ebinger, *Senegalia emilioana* (Fortunato & Cialdella) Seigler & Ebinger, *Senegalia etilis* (Speg.) Seigler & Ebinger, *Senegalia feddeana* (Harms) Seigler & Ebinger, *Senegalia fiebrigii* (Hassl.) Seigler & Ebinger, *Senegalia gilliesii* (Steud.) Seigler & Ebinger, *Senegalia grandistipula* (Benth.) Seigler & Ebinger, *Senegalia huberi* (Ducke) Seigler & Ebinger, *Senegalia kallunkiae* (Grimes & Barneby) Seigler & Ebinger, *Senegalia klugii* (Standl. ex J. F. Macbr.) Seigler & Ebinger, *Senegalia kuhlmannii* (Ducke) Seigler & Ebinger, *Senegalia lacerans* (Benth.) Seigler & Ebinger, *Senegalia* langsdorfii (Benth.) Seigler & Ebinger, *Senegalia lasophylla* (Benth.) Seigler & Ebinger, *Senegalia loretensis* (J. F. Macbr.) Seigler & Ebinger, *Senegalia macbridei* (Britton & Rose ex J. F. Macbr.) Seigler & Ebinger,

Senegalia magnibracteosa (Burkart) Seigler & Ebinger, *Senegalia martii* (Benth.) Seigler & Ebinger, *Senegalia martiusiana* (Steud.) Seigler & Ebinger, *Senegalia mattogrossensis* (Malme) Seigler & Ebinger, *Senegalia miersii* (Benth.) Seigler & Ebinger, *Senegalia mikanii* (Benth.) Seigler & Ebinger, *Senegalia mirandae* (L. Rico) Seigler & Ebinger, *Senegalia monacantha* (Willd.) Seigler & Ebinger, *Senegalia multipinnata* (Ducke) Seigler & Ebinger, *Senegalia nitidifolia* (Speg.) Seigler & Ebinger, *Senegalia olivensana* (G. P. Lewis) Seigler & Ebinger, *Senegalia parensis* (Ducke) Seigler & Ebinger, *Senegalia pedicellata* (Benth.) Seigler & Ebinger, *Senegalia piauhiensis* (Benth.) Seigler & Ebinger, *Senegalia piptadenioides* (G. P. Lewis) Seigler & Ebinger, *Senegalia praecox* (Griseb.) Seigler & Ebinger, *Senegalia pteridifolia* (Benth.) Seigler & Ebinger, *Senegalia quadriglandulosa* (Martius) Seigler & Ebinger, *Senegalia recurva* (Benth.) Seigler & Ebinger, *Senegalia rostrata* (Humb. & Bonpl. ex Willd.) Seigler & Ebinger, *Senegalia rurrenabaqueana* (Rusby) Seigler & Ebinger, *Senegalia santosii* (G. P. Lewis) Seigler & Ebinger, *Senegalia serra* (Benth.) Seigler & Ebinger, *Senegalia tenuifolia* (L.) Britton & Rose var. *producta* (Grimes) Seigler & Ebinger, *Senegalia trijuga* (Rizzini) Seigler & Ebinger, *Senegalia tubulifera* (Benth.) Seigler & Ebinger, *Senegalia tucumanensis* (Griseb.) Seigler & Ebinger, *Senegalia velutina* (DC.) Seigler & Ebinger, *Senegalia visco* (Lorentz ex Griseb.) Seigler & Ebinger, *Senegalia weberbaueri* (Harms) Seigler & Ebinger. Two new combination and new status changes are necessary: *Senegalia giganticarpa* (G. P. Lewis) Seigler & Ebinger, and *Senegalia parviceps* (Speg.) Seigler & Ebinger. One new name was required: *Senegalia scandens* Seigler & Ebinger. *Acacia kelloggiana* A. M. Carter & Rudd will be transferred elsewhere. Thirty-one other species that we recognize but which already have names in the genus *Senegalia* include: *Senegalia anisophylla* (S. Watson) Britton & Rose, *Senegalia angustifolia* (Lam.) Britton & Rose, *Senegalia berlandieri* (Benth.) Britton & Rose, *Senegalia crassifolia* (A. Gray) Britton & Rose, *Senegalia emoryana* (Benth.) Britton & Rose, *Senegalia gaumeri* (Blake) Britton & Rose, *Senegalia greggii* (A. Gray) Britton & Rose, *Senegalia hayesii* (Benth.) Britton & Rose, *Senegalia iguana* (M. Micheli) Britton & Rose, *Senegalia interior* Britton & Rose, *Senegalia macilenta* (Rose) Britton & Rose, *Senegalia maschalocephala* (Griseb.) Britton & Rose, *Senegalia*

micrantha Britton & Rose, *Senegalia muricata* (L.) Britton & Rose, *Senegalia occidenatlis* (Rose) Britton & Rose, *Senegalia painteri* Britton & Rose, *Senegalia peninsularis* Britton & Rose, *Senegalia picachensis* (Brandegee) Britton & Rose, *Senegalia podadenia* Britton and Killip, *Senegalia polyphylla* (DC.) Britton & Rose in Britton & Killip, *Senegalia purpusii* (Brandegee) Britton & Rose, *Senegalia reniformis* (Benth.) Britton & Rose, *Senegalia riparia* (Kunth) Britton & Rose ex Britton & Killip, *Senegalia roemeriana* (Scheele) Britton & Rose, *Senegalia sororia* (Standl.) Britton & Rose, *Senegalia subangulata* (Rose) Britton & Rose, *Senegalia subsessilis* Britton & Rose, *Senegalia tamarindifolia* (L.) Britton & Rose, *Senegalia tenuifolia* (L.) Britton & Rose, *Senegalia vogeliana* (Steud.) Britton & Rose, and *Senegalia wrightii* (Benth.) Britton & Rose.

KEY WORDS: *Acacia sensu lato*, Fabaceae, Mimosoideae, *Senegalia.*

The genus *Senegalia*

In addition to the approval of a recent proposal to conserve the name *Acacia* Miller with a conserved type, replacing *A. scorpioides* (L.) W. F. Wight [= *A. nilotica* (L.) Delile; subgen. *Acacia*] with *A. penninervis* (subg. *Phyllodineae*) (Orchard and Maslin 2003; McNeill *et al.* 2005), the morphological and genetic differences separating the subgenera of *Acacia s.l.*, suggest that this is an appropriate time to transfer the following taxa from *Acacia* subgenus *Aculeiferum* to the genus *Senegalia* Rafinesque (1838).

Recent morphological and genetic studies have shown that the genus *Acacia* s.l. is polyphyletic. This is supported by data derived from molecular studies, which have led to a better understanding of the relationships within the genus *Acacia* s.l., as well as the position of the genus within the Mimosoideae (Chappill and Maslin 1995, Maslin 1988, Clarke et al. 2000, Maslin et al. 2000, 2003, Miller and Bayer 2000, 2001, 2003, Luckow et al. 2003, Miller et al. 2003, Murphy et al. 2003). These studies suggest that the genus *Acacia* s.l. should be separated into a minimum of five genera. The resulting genera, for the most part, correspond to four previously recognized major infrageneric groups of *Acacia sensu lato* (i.e., subg. *Acacia*, subg. *Aculeiferum*,

subg. *Aculeiferum* section *Filicinae*, subg. *Phyllodineae*, and a small group of North and Central American species related to *Acacia coulteri* (in review as the proposed genus "*Mariosousa*"). In this work, we focus on American species of *Senegalia*. This publication represents an initial effort to establish the correct names, synonymy, and information on types for each of the American taxa belonging to former subg. *Aculeiferum* sect. *Aculeiferum* Pedley, i.e., excluding those belonging to *Acaciella* (Britton and Rose 1928) and the species related to *Acacia coulteri* (Seigler et al. in review). The remaining species are considered below as American representatives of the genus *Senegalia*.

Occasionally, we have included type information or other data concerning types as given by others. Our goal has been to make this information as complete and widely available to others as possible, but undoubtedly we have erred in some instances. We solicit updated information and corrections on any of these matters.

SENEGALIA Rafinesque, Sylva telluriana 119. 1838. – TYPE: *Senegalia triacantha* Raf., an illegitimate name based on *Mimosa senegal* L. [*Senegalia senegal* (L.) Britton & P. Wilson (1930)]. NOTE: The type of the name *Senegalia* is the type of *M. senegal*. Although the original material with which Linnaeus worked does not appear to be extant, there is a specimen [Senegal, 1749, *Adanson 59c* (P-Herb. Adanson (No. 16899)], neotypified and illustrated by Ross (1975) [Linnaean Typification Project Database (http://www.nhm.ac.uk/research-curation/projects/Linnaean-typification/index.html)]. Pedley (1986) indicates that, based on Rafinesque's system of designating types and names based on earlier ones, the name *Senegalia triacantha* is illegitimate. Because the citation of a species name as the type of a genus is merely a short-hand reference to its type (see Art. 10.1), the citation of an illegitimate name is not an issue here. Although not important for typification of *Senegalia*, the name *Acacia triacantha* Hochst. in A. Richard. (1847) was later legitimately published (Ross 1979).

American species formerly placed in the genus *Senegalia* Britton & Rose should remain there, with the exception of *Senegalia filicina* (Willd.) Pittier and *S. hirsuta* (Schldl.) Pittier, which were transferred to *Senegalia* by Pittier (1939), and *Senegalia angustissima* (Miller)

Pedley (1986), all of which should be transferred to the genus *Acaciella.*

Manganaroa Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 227. 1921. Type: *Manganaroa monacantha* (Willd.) Speg. *Acacia monacantha* Willd. Enum. pl. 1056. 1809. – TYPE: BRAZIL. Comes de Hoffmansegg (holotype: B-Willd.). NOTE: Spegazzini (1921) listed ten species that he considered to belong to the genus: *Manganaroa alemquerensis*, *M. altiscandens*, *M. articulata*, *M. furcata*, *M. martii*, *M. monacantha*, *M. paraensis*, *M. platensis*, *M. velutina*, and *M. paniculata*. All these names are included in the genus *Senegalia*. We have followed Pedley (1986, p. 238) in chosing *Manganaroa monacantha* as the type. Because of over emphasis on a single apparently pleisiomorphic character, the gland on the anther, the genus *Manganaroa* is comprised of a series of species that were not necessarily closely related within *Senegalia.*

Dugandia Britton & Killip, Ann. New York Acad. Sci. 35: 137. 1936. *Dugandia rostrata* (Humb. & Bonpl. ex Willd.) Britton & Killip. – TYPE: COLOMBIA. Habitat in America meridionale, *Humboldt & Bonpland s.n.* (holotype: P). NOTE: The one species attributed to this genus (*Dugandia rostrata*) belongs to the genus *Senegalia* (Guinet 1969, 1981; Pedley 1986). See *Senegalia rostrata* below.

Members of *Senegalia* are shrubs, trees, or lianas, unarmed or armed with prickles, but without stipular spines. The prickles usually are scattered, but less commonly are grouped in twos or threes, usually at or near the nodes (Vassal 1972). Leaves are bipinnate and the petiole and primary rachis have sessile or stipitate glands of variable position. Flowers possess a more or less tubular nectary below the usually stipitate ovary. Inflorescences are capitula or spikes, often grouped into complex terminal inflorescences. Pods are dehiscent, separating into two valves at maturity, or less commonly indehiscent or separating into indehiscent one seeded articles. The seeds are uniseriate (Cialdella, 1984; Madsen, 1990). The genus *Senegalia* consists of approximately 86 species and 2 varieties in the Americas (this study), 69 taxa in Africa, 43 taxa in Asia, and 2 taxa in Australia

(Maslin et al., 2003; Orchard and Maslin, 2003). Eight species occur in two or more areas.

Characters that distinguish *Senegalia* species from other subgroups of *Acacia sensu lato*.

Senegalia from *Vachellia*

Senegalia species can be distinguished from those of *Vachellia* by the absence of stipular spines and the presence of vegetative stipules, by the presence of prickles, by the presence of a torus-shaped nectary at the base of the ovary, and the fact that the ovaries are often pedicellate. The ovaries are usually subsessile or sessile in members of the genus *Vachellia*.

The pollen grains of *Senegalia* have columellae in contrast to those of the genus *Vachellia* (Guinet and Vassal 1978, Guinet 1981). The pollen grains of *Senegalia* are porate, but colporate in *Vachellia* (Guinet and Vassal 1978, Guinet 1981). Pollen grains of *Vachellia* species have three apertures; at least two among them are situated on the distal face of the monad and the number is less than the number of sides. They have three grooves fused at their extremities (Vassal 1972). Pollen collumelae are present in *Vachellia* but absent in *Senegalia* (Maslin et al. 2003).

Members of the genus *Vachellia* have a true involucre on the peduncle; this feature is lacking in *Senegalia*, although small bracts may be found.

The first three seedling leaves of most *Senegalia* species are bipinnate or a single pinnate leaf followed by two bipinnate leaves. *Vachellia* species produce two pinnate leaves followed by a bipinnate leaf (Vassal 1972).

Senegalia from species related to *Acacia coulteri*

Members of the genus *Senegalia* can be distinguished from those of a group of species related to *Acacia coulteri* by the presence of

prickles, and the order of development of the earliest leaves. Those of *Acacia coulteri* are pinnate, pinnate, and then bipinnate, whereas the first three leaves of *Senegalia* species are bipinnate or a single pinnate leaf followed by two bipinnate leaves (Vassal 1972).

Senegalia from subgenus *Acacia*

Members of the genus *Senegalia* can be distinguished from most members of *Acacia* (former *Acacia* subgenus *Phyllodineae*) by the presence of prickles and absence of phyllodes (Maslin et al. 2003).

The funiculus of many members of former *Acacia* subgenus *Phyllodineae* is arillate (Vassal 1972), whereas this characteristic only occasionally occurs in members of genus *Senegalia.*

The pollen of *Senegalia* species is of the porate type, whereas that of the *Phyllodineae* is normally of the extraporate type (Guinet and Vassal 1978). Pollen grains of *Senegalia* and *Acaciella* species have four pollen apertures, whereas those of Australian species (former *Acacia* subgenus *Phyllodineae*) have four apertures and four grooves parallel to the margin of the distal faces of the central monads and are always joined distant from the poles. The exine ornamentation of *Senegalia* species is smooth, whereas that of species of former subgenus *Phyllodineae* is reticulate.

The rust pathogens of members of the *Phyllodineae* are of the genera *Uromycladium* and *Uromyces*, whereas those of the *Senegalia* are of the genus *Ravenella* (Maslin et al. 2003). Species of *Senegalia* have a nectary “disk” below the ovary. Those of *Phyllodineae* lack this feature (Pedley 1986).

Senegalia from *Acaciella*

Members of the genus *Senegalia* can be distinguished from members of the genus *Acaciella* (formerly subg. *Aculeiferum* sect. *Filicinae* Pedley) by the presence of petiolar nectaries and the presence of prickles. Petiolar nectaries appear on all leaves of most species of *Senegalia*. The subtending floral bracts of *Senegalia* species are usually

caducous, whereas those of genus *Acaciella* are usually persistent. On dried specimens, the stamens of *Senegalia* are tan or brown or occasionally red-brown, whereas those of *Acaciella* possess a characteristic brown-orange color. The stipules of *Acaciella* species are often persistent, whereas those of *Senegalia* species are usually caducous.

<u>*Senegalia* from members of the Ingeae</u>

Members of genus *Senegalia* can usually be distinguished readily from members of the tribe Ingeae because the stamen filaments are free to the base. Those of Ingeae species are characteristically fused into a tube for a significant portion of the length of the filaments. Few members of the Ingeae have prickles; they are found on a few *Albizia* species. The leaves of many members of the genus *Inga* and one *Cojoba* species are pinnately compound.

Molecular data

Previous DNA studies have indicated that the genus *Acacia s.l.* is polyphyletic (Clarke et al. 2000, Miller and Bayer 2000, Robinson and Harris 2000, Luckow et al. 2002, Miller et al. 2003), but *Senegalia*, as defined in this manuscript, is monophyletic. Two other segregate groups that were part of *Acacia* subg. *Aculeiferum s.l.* were insufficiently sampled in these studies, but nonetheless shown to be distinct from *Senegalia*. These two groups consist of a small group of species related to *Acacia coulteri* (Seigler et al. in review) and the previously described genus *Acaciella* (Britton and Rose 1928). Two other species, *A. visco* and *A. galpinii*, did not show a close relationship to other members of former subg. *Aculeiferum* in the molecular phylogeny of Miller and Bayer (2003).

In the present study, DNA from 37 species of mimosoid legumes was sequenced for the chloroplast loci: *mat*K, *trn*L intron, *trn*L-*trn*F intergenic spacer region. Sampling included representatives of the major lineages of *Acacia sensu lato*, including *Senegalia* (syn. *Acacia* subg. *Aculeiferum*, in part), *Vachellia* (formerly subg. *Acacia*), *Acacia* (formerly *Acacia* subg. *Phyllodineae*), a group of species related to

Acacia coulteri, and *Acaciella* (syn. subg. *Aculeiferum* sect. *Filicinae*), as well as *A. visco*, *A. galpinii* and several species of the tribe Ingeae. *Mimosa tenuiflora* was used as the outgroup (Appendix 1). African representatives that will probably be referred to *Vachellia* and *Senegalia* in the future also have been included.

Maximum parsimony analyses were performed on the aligned sequences using the heuristic search option (excluding uninformative characters) in PAUP* 4.0 (Swofford 1999). A four-step search method for multiple islands was performed using 10,000 random replicates (Olmstead and Palmer 1994). Support for internal branches was evaluated by using the fast bootstrap method with 1000 replicates (Felsenstein 1985).

The heuristic analysis found 161 trees of 471 steps with a CI of 0.67 and an RI of 0.85. The consensus tree with bootstrap support is shown in figure 1. The basal clade (Clade A) is *Vachellia*, which is supported by a bootstrap value of 100% and contains both American and African species.

All species other than those of *Vachellia* are placed in a separate clade (Clade B, 66% bootstrap support). This confirms previous results indicating that *Vachellia* is relatively distantly related to other members of *Acacia s.l.* (Luckow et al. 2003, Miller et al. 2003).

The genus *Senegalia* (Clade C) is supported by a bootstrap value of 72% and is comprised of two main subclades. One clade (Clade D) is comprised of only African and Asian species (100% bootstrap value) and the other (Clade E) contains several American and a single African species (*A. schweinfurthii*; 97% bootstrap value).

The other main clade (Clade F) of this phylogeny is comprised of a group of species that encompasses species "*Mariosousa*" that are related to *Acacia coulteri* (Clade G, 78% bootstrap value), *Acaciella* (Clade H, 100% bootstrap value), and the combined Ingeae/*Acacia* (Clade I, 79% bootstrap value) and *Acacia* (Clade J, 88% bootstrap value).

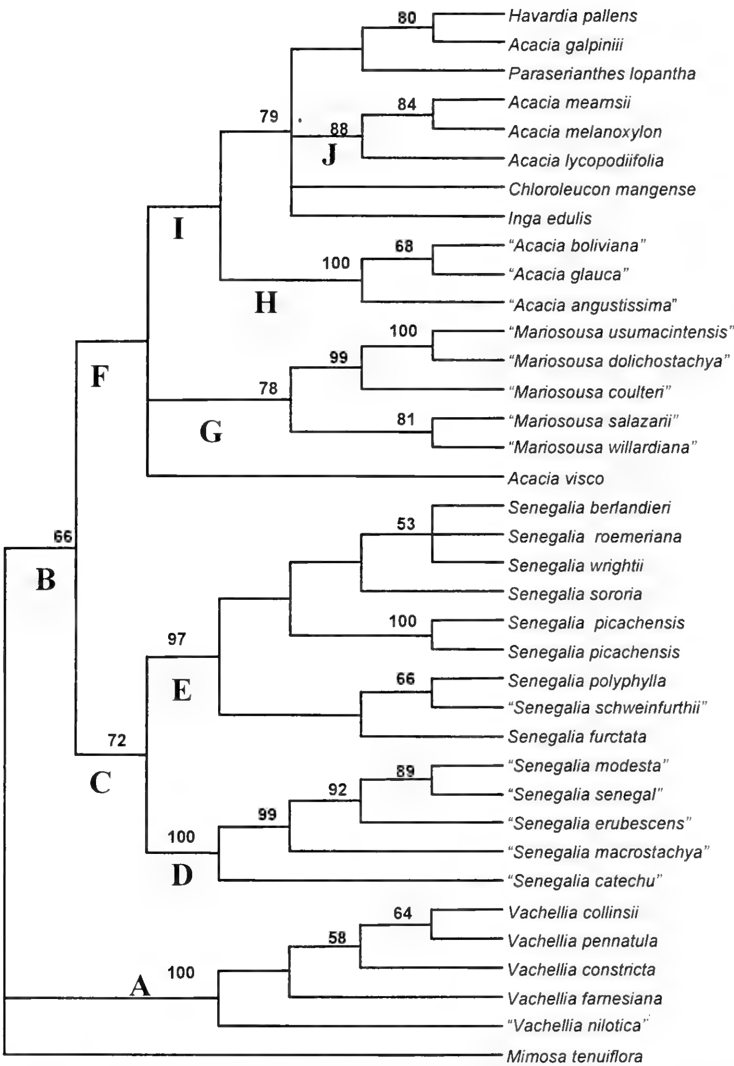

Figure 1. Consensus tree of 161 most parsimonious trees from the *mat*K and *trn*L combined datasets. Bootstrap values are above branches. Refer to text for discussion of the clades labeled A-J.

Acacia visco and *A. galpinii*, previously placed in *Acacia* subg. *Aculeiferum*, did not fall within the *Senegalia* clade (Clade C), but are found in Clade F. This placement is in accord with previous work (Miller et al. 2003, Luckow et al. 2003). The generic status of these two species must be further investigated.

In conclusion, increased sampling of the present study confirms the results of previous results that indicated polyphyly of *Acacia s.l.* and support previous recommendations that *Acacia s.l.* be separated into at least five genera (Pedley 1986, Maslin et al. 2003).

AMERICAN SPECIES OF *SENEGALIA*

1. **SENEGALIA ALEMQUERENSIS** (Huber) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia alemquerensis* Huber, Bol. Mus. Paraense Hist. Nat. 5: 380. 1909; *Manganaroa alemquerensis* (Huber) Speg., Physis (Buenos Aires). 6: 313. 1923. – TYPE: BRAZIL. PARÁ: hab. in silvis capueiras prope Alemquer, Rio Tapajos, 26 Jun 1918, *A. Ducke 17072* [holotype: MG (F, MO photos); isotypes: G].

Acacia alvaroi Cárdenas & De Martino, Ernstia. 56: 10. 1989. – TYPE: VENEZUELA. BOLÍVAR: Distrito Heres. Campamento Curi, en la vía al edificio de comunicaciones, Jan-Feb 1984, *A. Fernández 852* (holotype: MY; isotype: PORT). NOTE: Cárdenas and G. De Martino (1990) placed *Acacia alvaroi* in synonymy under *Acacia alemquerensis*.

2. **SENEGALIA ALTISCANDENS** (Ducke) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia altiscandens* Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 72. 1922; *Manganaroa altiscandens* (Ducke) Speg., Physis (Buenos Aires) 6: 312. 1923.– TYPE: BRAZIL. PARÁ: near Bela Vista on the Tapajóz River, 12 Sep 1916, *A. Ducke 16486* [lectotype, designated here: RB (F photo); isolectotypes: G, MG, R]; [paralectotypes: *A. Ducke 16486*; *16914*; *16599*].

3. **SENEGALIA AMAZONICA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia amazonica* Benth. Trans. Linn. Soc. London

30: 523. 1875. – TYPE: BRAZIL. North Brazil, in "Gapo" ad Manaquiry prope Manaos, prov. do Alto Amazônas, *R. Spruce 1697* (holotype: K).

4. SENEGALIA ANISOPHYLLA (S. Watson) Britton & Rose, N. Amer. Flora 23: 109. 1928; *Acacia anisophylla* S. Watson, Proc. Amer. Acad. Arts 21: 452. 1886. – TYPE: MEXICO. COAHUILA: mountains, cañones near Jimulco, 14 May 1885, *C. G. Pringle 163* [holotype: GH (MEXU photo); isotypes: GH, K, NY]. NOTE: Probable hybrid of *Acacia berlandieri* and *A. crassifolia* according to Johnston (1975) and Glass (2003).

5. SENEGALIA ANGUSTIFOLIA (Lam.) Britton & Rose, N. Amer. Fl. 23: 113. 1928; *Mimosa angustifolia* Lam., Encycl. 1: 12. 1783, non Jacquin (1798). – TYPE: DOMINICAN REPUBLIC. [holotype: B from Dominican Republic, probably Barahona (Howard, 1988)]. NOTE: The name *Acacia angustifolia* (Jacq.) H. L. Wendland (1820), which is based on *Mimosa angustissima* Jacquin (1798), is a synonym of *Acacia suaveolens* (Sm.) Willd., a phyllodinous acacia species from Australia (Maslin 2001).

Acacia skleroxyla Tussac, Fl. Antill. 1: 146. (pl. 21). 1808. – TYPE: Antilles. Santo Domingo [holotype: pl. 21 from Tussac (1808)]. NOTE: Barneby and Zanoni (1989) observed that the correct orthography is *skleroxyla* as used by Tussac (1808), not *scleroxyla*.

Mimosa tenuifolia Descourtilz, Fl. med. Antilles 2: 105. (t. 93). 1822, nom. illeg. *Mimosa tenuifolia* Linnaeus (1753) is the basionym of *Senegalia tenuifolia* (see below).

6. **SENEGALIA BAHIENSIS** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia bahiensis* Benth., Trans. Linn. Soc. London 30: 525. 1875. – TYPE: BRAZIL. BAHIA: habitat in silvis catingas, *C. F. P. von Martius 6171* [holotype: M (G photo, MO photo); isotypes: F, NY].

Acacia tavaresorum Rizzini, Leandra 3-4(4-5): 13. 1974. – TYPE: BRAZIL. BAHIA: Caraçá, Fazenda Arapuá, 30 May 1973, *D. P. Lima 13152* [holotype: RB (K photo)].

7. SENEGALIA BERLANDIERI (Benth.) Britton & Rose, N. Amer. Fl. 23: 109. 1928; *Acacia berlandieri* Benth., London J. Bot. 1: 522. 1842. – TYPE: MEXICO. NUEVO LEÓN: Monterrey, Jan 1828, *M. Berlandier 1392* [lectotype, designated here: OXF (MEXU photo); isolectotypes G, GH, P]; [paralectotype: Texas, *Berlandier s.n.*]. NOTE: See Isely (1969) and Glass (2003) for discussion of type. Bentham (1842) cited (Monterey, Texas, *Berlandier*). Although Bentham's statement is ambiguous, we have interpreted it to mean that there are syntypes, both collected by Berlandier, one from Monterrey, N. L., Mexico, which we lectotypify above, and one from Texas that we have not seen.

Acacia tephroloba A. Gray, Pl. wright. 1: 65. 1852. – TYPE: UNITED STATES. TEXAS: expedition from Western Texas to El Paso, New Mexico, May-Oct 1849, *C. Wright 175* and *176* (syntypes: GH).

8. **SENEGALIA BONARIENSIS** (Gillies ex Hook. & Arn.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia bonariensis* Gillies ex Hook. & Arn., Bot. Misc. 3: 207. 1833. TYPE: ARGENTINA. Buenos Aires, *Dr. Gillies s.n.* (lectotype, designated here: K); [paralectotypes: Entre Rios, *Tweedie s.n.* (K)]. NOTE: These two specimens are mounted on the same sheet at K.

9. **SENEGALIA CATHARINENSIS** (Burkart) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia catharinensis* Burkart, in Barth & Yoneshigue, Mem. Inst. Oswaldo Cruz 64: 96. 1966. – TYPE: BRAZIL. SANTA CATARINA: Pilões, Palhoça, Santo Amaro da Imperatriz, mata, 400 m, flor branca, 11 Jan 1957, *R. M. Klein 2172* (holotype: SI; isotypes: B, HBR). NOTE: See Burkart (1979) for discussion of the type.

10. SENEGALIA CRASSIFOLIA (A. Gray) Britton & Rose, N. Amer. Fl. 23: 108. 1928; *Acacia crassifolia* A. Gray, Mem. Amer. Acad. Arts n.s. 5: 317. 1854. – TYPE: MEXICO. COAHUILA: in the mountain pass of La Peña, Nov 1852, *G. Thurber 829* [holotype: GH (MEXU photo); isotypes: K, MO, NY]. NOTE: For more information on this species see Bentham (1876b) and Glass (2003).

Bauhinia lunarioides A. Gray in S. Watson, Smithsonian Misc. Collect. 258: 205. 1878.

11. **SENEGALIA EMILIOANA** (Fortunato & Cialdella) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia emilioana* Fortunato & Cialdella, Candollea 51: 217. 1996. – TYPE: PARAGUAY. ALTO PARAGUAY: 20 km al N del Puesto 4 de Mayo, por linea 6, 20° 10' S, 60° 32' W, quebrachal, 24 Oct 1992, *R. H. Fortunato, L. Ramella, & R. Palese 3620* (holotype: BAB; isotype: G).

12. SENEGALIA EMORYANA (Benth.) Britton & Rose, N. Amer. Fl. 23: 109. 1928; *Acacia emoryana* Benth., Trans. Linn. Soc. London. 30: 522. 1875. – TYPE: UNITED STATES. TEXAS: near Socale Creek. (Emory Expedition), 1851-1852, *J. Bigelow 325* [lectotype, designated here: OXF (MEXU photo); isolectotypes: NY, US]; [paralectotype: Texas, *C. Wright 179*]. NOTE: This species is probably a hybrid of *Acacia berlandieri* and *Acacia greggii* according to Johnston (1974) and Glass (2003). Because Britton and Rose (1928) listed the type locality as Socale Creek, Texas, we selected that specimen as the lectotype.

13. **SENEGALIA ETILIS** (Speg.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia etilis* Speg., Revista Argent. Bot. 1: 75. 1925. – TYPE: ARGENTINA. SALTA: In dumetis circa Tartagal, Feb 1923, *P. L. Hauman s.n.* (holotype: LP). NOTE: See Cialdella (1984, 1997) and Gutiérrez et al. (2002) for a drawing of *Senegalia etilis* and information on the type.

14. **SENEGALIA FEDDEANA** (Harms) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia feddeana* Harms, Feddes Repert. Spec. Nov. Regni Veg. 16: 450. 1920; *Acacia fiebrigii* Harms, Feddes Repert. Sp. Nov. Regni Veg. 16: 351. 1920, nom. illeg., non Hassler (1910). – TYPE: BOLIVIA. S. Bolivien, Rencillo bei Tupiza, alt. 2700-3000 m, 28 Feb 1904, *K. Fiebrig 3113* [holotype: B (F photo); isotypes: B, BM, F fragment, G, MO].

Acacia molfinoi Speg., Bol. Acad. Nac. Ci. (Córdoba) 26: 219. 1921. NOTE: No type cited. Based on Spegazzini's description, this taxon appears to be conspecific with *Senegalia feddeana* (Harms) Seigler & Ebinger.

15. **SENEGALIA FIEBRIGII** (Hassl.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia fiebrigii* Hassl., Feddes Repert. Sp. Nov. Regni Veg. 8: 553. 1910, non Harms (1920a). – TYPE: PARAGUAY. N. Paraguay, San Luis, between Río Apa and Río Aquidaben, Dec 1908/1909, *K. Fiebrig 4421* (holotype: G; isotype: GH, K). NOTE: *Acacia fiebrigii* Harms (1920a,b) is a synonym of *Senegalia feddeana* (see above).

16. SENEGALIA GAUMERI (Blake) Britton & Rose, N. Amer. Fl. 23: 110. 1928; *Acacia gaumeri* Blake, Proc. Biol. Soc. Wash. 34: 44. 1921. – TYPE: MEXICO. YUCATÁN: 3 miles inland from Silám, May 1916, *G. F. Gaumer & sons 23332* (holotype: F).

17. **SENEGALIA GIGANTICARPA** (G. P. Lewis) Seigler & Ebinger, **comb. et stat. nov.** Basionym: *Acacia polyphylla* DC. var. *giganticarpa* G. P. Lewis, Kew Bull. 51: 591. 1996. – TYPE: BRAZIL. BAHIA: munícipio de Itabuna, about 3 km NW of Juçari, 8 Mar 1978, *S. A. Mori, J. A. Kullunki, & T. D. Pennington 9575* (holotype: CEPEC; isotypes: F, K, NY, RB, US).

18. **SENEGALIA GILLIESII** (Steud.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia gilliesii* Steud., Nomencl. bot. 2: 5. 1841; *Acacia furcata* Gillies ex Hook. & Arn., Bot. Misc. 3: 206. 1833, nom. illeg., non (Desf.) Desvaux (1814); *Manganaroa furcata* (Gillies ex Hook. & Arn.) Speg., Bol. Acad. Nac. Ci. (Córdoba) 26: 228. (fig. 11). 1921; *Acacia furcatispina* Burkart, Darwiniana 7: 512. 1947. – TYPE: ARGENTINA. MENDOZA: uncultivated places at the foot of the Andes of Mendoza, *Dr. Gillies s.n.* [lectotype, designated here: E (K photo, SI photo); isolectotypes: F, K]; [paralectotype: Buenos Ayres (cultivated), *Tweedie s.n.*]. NOTE: *Acacia furcata* (Desf.) Desvaux (1814) is an African *Prosopis* species.

19. **SENEGALIA GRANDISTIPULA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia grandistipula* Benth., London J. Bot. 1: 511. 1842. TYPE: BRAZIL. RIO DE JANEIRO. habitat in Serra dos Orgãos (Organ Mountains), *G. Gardner 361* [lectotype, designated here: K (NY photo)]; [paralectotype: *F. Sello 535*].

20. SENEGALIA GREGGII (A. Gray) Britton & Rose, N. Amer. Fl. 23: 110. 1928; *Acacia greggii* A. Gray, Pl. wright. 1: 65. 1852. – TYPE: MEXICO. CHIHUAHUA: west of Patos (dry valley), 10 Apr 1847, *Dr. Gregg s.n.* (holotype: GH). NOTE: For more information on this type, see Isely (1969, 1998) and Glass (2003).

Acacia durandiana Buckley, Proc. Acad. Nat. Sci. Philadelphia. 1861: 453. 1862. – TYPE: UNITED STATES. TEXAS: near Ft. Belknap, Jun 1861, *S. B. Buckley s.n.* (holotype: PH).

Acacia greggii A. Gray var. *arizonica* Isely, Sida 3: 377. 1969. – TYPE: UNITED STATES. ARIZONA: Yavapai Co., Montezuma Well, near Camp Verde, alt. 3550 ft., 18 Jul 1948, *Schroeder 114* (holotype: ISC).

21. SENEGALIA HAYESII (Benth.) Britton & Rose, N. Amer. Fl. 23: 114. 1928. Basionym: *Acacia hayesii* Benth., Trans. Linn. Soc. London 30: 524. 1875. – TYPE: PANAMÁ. Mammee Station of the railroad, shrubby timber, 29 Sep 1861, *S. Hayes 165* [holotype: K (MEXU photo, US photo); isotypes: BM, US fragment].

Senegalia acanthophylla Britton & Rose, N. Amer. Fl. 23: 118. 1928; *Acacia acanthophylla* (Britton & Rose) Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 18: 488. 1937. – TYPE: COSTA RICA. La Florida, 18 Jun 1897, *H. Pittier 11278* (holotype: NY; isotype: US).

Senegalia rekoana Britton & Rose, N. Amer. Fl. 23: 114. 1928. – TYPE: MEXICO. OAXACA: Cerro Espino, Oct 1917, *B. P. Reko 3639* (holotype: NY).

Acacia telensis Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 4: 308. 1929. – TYPE: HONDURAS. ATLÁNTIDA: wet thicket,

Lancetilla Valley, near Tela, alt. 75 m, 9 Dec 1923, *P. C. Standley 52738* (holotype: F).

22. **SENEGALIA HUBERI** (Ducke) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia huberi* Ducke, Arch. Jard. Bot. Rio de Janeiro 5: 123. 1930. – TYPE: BRAZIL. AMAZÔNAS: habitat ad ripas periodice inundatis fluminis Purús loco Bom Logar (civitate Amazonas), 10 May 1904, *J. Huber 4705* (lectotype, designated here: MG; isolectotype: RB); [paralectotype: *J. G. Kuhlmann 17488*]. NOTE: *Acacia luberi* Ducke is apparently a typographical error for *Acacia huberi* Ducke that occurs on labels of several herbarium sheets.

23. SENEGALIA IGUANA (M. Micheli) Britton & Rose, N. Amer. Fl. 23: 114. 1928; *Acacia iguana* M. Micheli, Mém. Soc. Phys. Genève 34: 281. (pl. 25). 1903. – TYPE: MEXICO. GUERRERO: La Puerta, 50 m, Oct 1898, *E. Langlassé 422* (holotype: G; isotypes: MEXU, K, P).

Senegalia membranacea Britton & Rose, N. Amer. Fl. 23: 119. 1928. – TYPE: MEXICO. VERACRUZ: Remulatero, Apr 1922, *C. A. Purpus 8716* [holotype: US (MEXU, MO photos); isotype: NY].

24. SENEGALIA INTERIOR Britton & Rose, N. Amer. Fl. 23: 109. 1928; *Acacia interior* (Britton & Rose) McVaugh, Fl. Novo-Galiciana 5: 130. 1987. – TYPE: MEXICO. JALISCO: Bolaños, 10-19 Sep 1897, *J. N. Rose 2893* [holotype: US (K photo, NY photo); isotype: K, NY]. NOTE: For more information on this species see Glass (2003).

25. **SENEGALIA KALLUNKIAE** (Grimes & Barneby) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia kallunkiae* Grimes & Barneby, Brittonia 37: 186. 1985. – TYPE: BRAZIL. BAHIA: rd. 265. trecha que liga a BR 415 com Caatiba, 3 km da BR 415, 3 Mar 1978, *S. A. Mori et al. 9373* (holotype: CEPEC; isotypes: K, NY).

26. **SENEGALIA KLUGII** (Standl. ex J. F. Macbr.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia klugii* Standl. ex J. F. Macbr., Publ. Field Mus. Nat. Hist., Bot. Ser. 13: 78. 1943. – TYPE: PERU.

SAN MARTÍN: Juanjuí Alto Río Huallaga, 400-800 m, Mar 1936, *G. Klug 4272* (holotype: F; isotypes BM, MO).

27. **SENEGALIA KUHLMANNII** (Ducke) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia kuhlmannii* Ducke, Arch. Jard. Bot. Rio de Janeiro 5: 123. 1930. – TYPE: BRAZIL. AMAZÔNAS: Rio Solimões, Amazônas, in ripis fluvii Solimões loco Anory, 19 Jan 1924, *J. G. Kuhlmann 17489* (lectotype, designated here: RB; isolectotypes: F fragment; K); [paralectotype: *A. Ducke 20177*].

28. **SENEGALIA LACERANS** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia lacerans* Benth., London J. Bot. 1: 511. 1842. – TYPE: BRAZIL. RIO DE JANEIRO: *F. Sello s.n.* (type: not seen).

29. **SENEGALIA LANGSDORFII** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia langsdorfii* Benth., London J. Bot. 1: 521. 1842. – TYPE: BRAZIL. MINAS GERAIS: Serra da Lapa, *Langsdorff s.n.* [holotype: K (NY photo); isotypes: F, SI fragment].

30. **SENEGALIA LASIOPHYLLA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia lasiophylla* Benth., Trans. Linn. Soc. London 30: 527. 1875. – TYPE: BRAZIL. MINAS GERAIS: Habitat in sepibus ad Salgado provinciae Minas Gerais, Aug, *C F. P. von Martius 6172* [holotype: M (F photo, K photo, MO photo); isotype: G]. NOTE: In the original description, Bentham (1875) gave only the locality (as "Minas Geraes"), but he did not cite a collector. This was corrected by Bentham in 1876a where he cited *Martius 6172*.

31. **SENEGALIA LORETENSIS** (J. F. Macbr.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia loretensis* J. F. Macbr., Publ. Field Mus. Nat. Hist., Bot. Ser. 13: 79. 1943. – TYPE: PERU. LORETO: Gamitanococha, Río Mazán, river bank, alt. 100-125 m, 1 Feb 1935, *J. M. Schunke 157* (holotype: F).

Acacia riparia Kunth var. *angustifolia* Kuntze, Rev. gen. pl. 3: 47. 1898. – TYPE: BOLIVIA. SANTA CRUZ: Sierra de Santa Cruz., 2000 m, May 1892, *O. Kuntze s.n.* (lectotype, designated here: NY; isolectotype: F); [paralectotype: Argentina].

32. **SENEGALIA MACBRIDEI** (Britton & Rose ex J. F. Macbr.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia macbridei* Britton & Rose ex J. F. Macbr., Publ. Field Mus. Nat. Hist., Bot. Ser. 13: 78. 1943. – TYPE: PERU. JUNÍN: La Merced, liana-like in debris along river, alt. 2000 ft., 10-24 Aug 1923, *J. F. Macbride 5326* [holotype: F (G photo, NY photo, US photo); isotypes: G, NY fragment; US fragment]. NOTE: Macbride (1943) designated *J. F. Macbride 5326* as the type, but listed other specimens as representative material. Macbride (1943) indicated that the name came from Britton and Rose.

33. SENEGALIA MACILENTA (Rose) Britton & Rose, N. Amer. Fl. 23: 111. 1928; *Acacia macilenta* Rose, Contr. U. S. Natl. Herb. 8: 31. 1903. – TYPE: MEXICO. COLIMA: on river bottoms and mountainsides near Colima, 9 Jan-6 Feb 1891, *E. J. Palmer 1209* (holotype: US; isotypes: BM, F, MEXU, MO, NY, VT). NOTE: See Rico-Arce (1995) for a additional information on the synonyms of *Senegalia macilenta.*

Senegalia oaxacana Britton & Rose, N. Amer. Fl. 23: 110. 1928. – TYPE: MEXICO. OAXACA: valley of Oaxaca, 8 Sep 1894, *E. W. Nelson 1249* [holotype: NY (MEXU photo); isotypes GH, US]. NOTE: Not *Myrmecodendron oaxacanum* Britton & Rose (1928), an ant-acacia from Mexico that is presently considered a synonym of *Vachellia* X *standleyi* (Safford) Seigler & Ebinger (Seigler and Ebinger 2005). These names (but not the plants themselves) are sometimes confused because both are "acacia" species.

Lysiloma cuernavacana Britton & Rose, N. Amer. Fl. 23: 78. 1928; *Acacia cuernavacana* (Britton & Rose) Sandwith, Kew Bull. 1936: 8. 1936. – TYPE: MEXICO. MORELOS: valley below Cuernavaca, 16 Oct 1900, *C. G. Pringle 8382* (holotype: NY; isotypes: BM, E, G, GH, K, MEXU, MICH, MINN, MO, UC, US).

34. **SENEGALIA MAGNIBRACTEOSA** (Burkart) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia magnibracteosa* Burkart, Fl. Ilustr. Catarinense (Leguminosas Mimosoideas) 30: 41. 1979. – TYPE: BRAZIL. RIO GRANDE DO SUL: São Francisco de Paula, Vila Oliva, in araucarieto, 7 Jan 1946, *B. Rambo 30749* (holotype: SI;

isotypes: PACA). NOTE: This species is known to us only from the description (Burkart 1979).

35. **SENEGALIA MARTII** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia martii* Benth., London J. Bot. 1: 519. 1842; *Acacia paniculata* Willd. var. *martii* (Benth.) Hassl., Feddes Repert. Sp. Nov. Regni Veg. 16: 153. 1920; *Manganaroa martii* (Benth.) Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 249. 1921. – TYPE: BRAZIL. RIO DE JANEIRO: *C. F. P. von Martius 1106* [holotype: K (F photo, K photo, MO photo, SI photo); isotypes: B, BM, F fragment, G, NY, P].

Acacia paniculata Willd. var. *incana* Chod. & Hassl., Bull. Herb. Boissier 4(series 2): 486. 1904. – TYPE: PARAGUAY. CONCEPCIÓN: in dumetis glareosis prope Concepción, Sep 1901-1902, *E. Hassler 7369* (holotype: G; isotype: F, MO, NY).

Manganaroa paniculata (Willd.) Speg. var. *paraguayensis*, Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 244. 1921. – TYPE: PARAGUAY. In altaplanite et declivibus Sierra de Amambay, *T. Rojas 10645* (LPS 14307) (holotype: LP; isotype: BM, NY). NOTE: See Cialdella (1984) and Gutiérrez et al. (2002) for discussion of type.

36. **SENEGALIA MARTIUSIANA** (Steud.) Seigler & Ebinger, **comb. nov.** Basionym: *Mimosa martiusiana* Steud., Nomencl. bot. 2: 148. 1840; *Mimosa adhaerens* Martius, "Herb. fl. bras." Flora. 20(2): Beiblätter. 122. 1837. *nom. illeg.*, non Kunth (Humboldt t al. 1823); *Acacia adhaerens* Benth., London J. Bot. 1: 517. 1842; *Acacia martiusiana* (Steud.) Burkart, Fl. Ilustr. Catarinense (Leguminosas Mimosoideas) 30: 30. 1979. – TYPE: BRAZIL. GUANABARA: in monte Serra d'Estrela prov. Sebastianopolitanae, locis apricis, in sepibus, *C. F. P. von Martius 174* [holotype: M (MO photo); isotypes: F, K, MO]. NOTE: *Mimosa adhaerens* Kunth (Humbolt, Bonpland, and Kunth 1823) is now considered to be a synonym of *Mimosa albida* Humb. & Bonpl. ex Willd. (Rudd 1968).

Acacia micradenia Benth., London J. Bot. 1: 518-519. 1842. – TYPE: BRAZIL. *Pohl* (holotype: not seen). NOTE: Although we

have not seen type material, Bentham (1875, 1876a) considered this species to be conspecific with *Acacia adhaerens*.

Acacia subpaniculata Hoehne, Revista Mus. Paul. Univ. São Paulo 10: 653. (pl. 1). 1918. – TYPE: BRAZIL. SÃO PAULO: Botucatú, Nov 1896, *G. Edwall 13129* (holotype: SP; isotype NY).

Acacia spegazziniana Kuhlmann, Arch. Jard. Bot. Rio de Janeiro 4: 355. 1925. – TYPE: BRAZIL. RIO DE JANEIRO: ad urbem in silvis Mundo Novo, Botafogo, 11 Jul 1922, *J. G. Kuhlmann 13386* [holotype: RB (G photo); isotypes G, K, LP, NY, P, US]. NOTE: In the original description the type is erroneously listed as J. G. Kuhlmann 133.386 (Burkart 1979).

37. SENEGALIA MASCHALOCEPHALA (Griseb.) Britton & Rose, N. Amer. Fl. 23: 118. 1928; *Acacia maschalocephala* Griseb., Cat. pl. Cub. 82. 1866. – TYPE: CUBA. eastern Cuba, *C. Wright 2395* [holotype: GOET (ILL photo); isotypes G, GH, HAC, K, P, NY, S, US]. NOTE: For information on the type see Bässler (1998).

38. **SENEGALIA MATTOGROSSENSIS** (Malme) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia mattogrossensis* Malme, Ark. Bot. 23A(13): 45. 1931. – TYPE: BRAZIL. MATO GROSSO: Santa Anna da Chapada, in silvis, pluribus locis, 6 Aug 1902, *G. O. A. Malme 2211* (holotype: S).

39. SENEGALIA MICRANTHA Britton & Rose, N. Amer. Fl. 23: 115. 1928 non *Acacia micrantha* Desv. in Hamilton (1825); Acacia *micrantha* Benth., Trans. Linn. Soc. London 30: 526. 1875, *nom. illeg.*; *Acacia parviflora* E. L. Little, Phytologia 6: 506. 1959, nom. illeg. superfl. – TYPE: MEXICO. TAMAULIPAS: between Las Apuntas and Las Verdosas, Herbarium Berlandierum Texano-Mexicanum, *M. Berlandier 3148* (lectotype, designated here: K; isotypes: MO, NY); [paralectotype: *C. A. Ehrenberg s.n.* (B, probably destroyed)]. NOTE: *Acacia micrantha* Desv. (Hamilton 1825) is a synonym of *Chloroleucon mangense* (Jacq.) Britton & Rose (1928).

40. **SENEGALIA MIERSII** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia miersii* Benth., London J. Bot. 1. 522. 1842. – TYPE: BRAZIL. RIO DE JANEIRO: aqueduct of Rio de Janeiro, *J. Miers 3864* (holotype: K).

41. **SENEGALIA MIKANII** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia mikanii* Benth., Trans. Linn. Soc. London 30: 526. 1875. – TYPE: BRAZIL. RIO DE JANEIRO: habitat ad Christoforo, *J. C. Mikan s. n.* [holotype: W (G, MO photos)].

42. **SENEGALIA MIRANDAE** (L. Rico) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia mirandae* L. Rico, Bol. Soc. Bot. Mexico 43: 68. (fig. 2). 1982. – TYPE: MEXICO. OAXACA: Cima del cerro Estación de Microondas Palma Sola, Mpio. El Barrio, Distr. de Juchitán, 610 m, 18 Dec 1978, *M. Sousa 10232* [holotype: MEXU (K photo); isotypes: BM, NY].

43. **SENEGALIA MONACANTHA** (Willd.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia monacantha* Willd., Enum. pl. 1056. 1809; *Manganaroa monacantha* (Willd.) Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 233. 1921. – TYPE: BRAZIL. *Comes de Hoffmannsegg* (holotype: B-Willd.).

Acacia dumetorum (St. Hil.) DC., Prod. 2: 458. 1825. *Mimosa dumetorum* St. Hil., Mem. Mus. Paris 9: 316. 1822. TYPE: BRAZIL. in Brasiliae sylvulis nanis dumetosis ad Minas-Novas.

Acacia spini Balbis in DC., Prod. 2: 460. 1825., De Spin, Cat. suppl. p. 8. 1804. TYPE: not seen.

Acacia rojasii Hassl., Feddes Repert. Sp. Nov. Regni Veg. 8: 553. 1910. – TYPE: PARAGUAY. GRAN CHACO: Ad ripam occidentalem fluminis Paraguay, in dumetis, Jan 1903, *E. Hassler 2903* [holotype: G (F photo); isotypes: BM, K, P, SI].

Acacia monacantha Willd. f. *schulziana* Burkart, Legum. Argent., ed. 2: 542. 1952. – TYPE: ARGENTINA. CHACO: Colonia

Benítez, *A. G. Schulz 2012* (holotype: SI). NOTE: See Cialdella (1984, 1997) for additional information on the type.

44. **SENEGALIA MULTIPINNATA** (Ducke) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia multipinnata* Ducke, Arch. Jard. Bot. Rio de Janeiro 4: 31. 1925; *Acacia multipunctata* Ducke in Lemée, Fl. Guyane française 2: 57. 1952, nom. illeg. – TYPE: BRAZIL. PARÁ: lecta in regione Ariramba fluminis Trombetas, 10 Dec 1910, *A. Ducke 11411* [lectotype (Grimes, 1992) MG; isolectotypes: NY, US]; [paralectotypes: *Ducke 10457*, *R. Spruce 494*, and *Kuhlmann 17487*].

Senegalia tomentella Britton & Killip, Ann. New York Acad. Sci. 35: 145. 1936. – TYPE: COLOMBIA. forest, Rio Putumayo at the Colombia-Peru boundary, 26 Sep-10 Oct 1930, *G. Klug 1651* (holotype: NY; isotype MO).

Senegalia cordobana Britton & Killip, Ann. New York Acad. Sci. 35: 143. 1936. – TYPE: COLOMBIA. CÓRDOBA: cliffs along Rio Dagua, El Valle, alt. 80-100 m, 9 Oct 1922, *E. P. Killip 11771* (holotype: NY; isotype US).

45. SENEGALIA MURICATA (L.) Britton & Rose, N. Amer. Fl. 23: 113. 1928. *Mimosa muricata* L., Syst. Nat. ed. 2: 1504. 1759; *Acacia muricata* (L.) Willd., Sp. pl. 4: 1058. 1806. – TYPE: [lectotype (Howard 1988): t. 11 in Plumier (1755)].

Mimosa nigricans Vahl, Eclog. amer. 3: 37. (t. 29). 1807, nom. illeg., non Labillardière (1806; actual date of publication, March 1807); *Acacia rohriana* DC., Prod. 2: 457. 1825. – TYPE: Amer. meridionali, *von Rohr s.n.* [holotype: C (F photo)]. NOTE: *Mimosa nigricans* Labillardière (1806) is the basionym of *Acacia nigricans* R. Br. (Aiton 1813), an Australian species.

Acacia nudiflora Rich. in Willd., Sp. pl. 4: 1058. 1806. *Mimosa nudiflora* (Rich.) Rich. in Poir., Encycl. Suppl. 1: 65. 1810. – TYPE: VIRGIN ISLANDS. "Danish America" (holotype: B-Willd.; isotype: P).

46. **SENEGALIA NITIDIFOLIA** (Speg.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia nitidifolia* Speg., Bol. Acad. Nac. Ci. (Córdoba) 26: 191. 1921. – TYPE: ARGENTINA. CORRIENTES: Colección de Maderas Argentinas, Exp. 1910. Corrientes, 66, *C. Spegazzini s.n.* (LPS 11915) [lectotype (Burkart 1979): LP]; [paralectotype: *T. Rojas 4577* (LP)]. NOTE: For more information on these types see Cialdella (1984).

47. SENEGALIA OCCIDENTALIS (Rose) Britton & Rose, N. Amer. Fl. 23: 117. 1928; *Acacia occidentalis* Rose, Contr. U. S. Natl. Herb. 8: 32. 1903. – TYPE: MEXICO. SONORA: along railroad between Nogales and Guaymas, 4 Jun 1897, *J. N. Rose 1294* (holotype: US). NOTE: For additional discussion of the species see Glass (2003).

48. **SENEGALIA OLIVENSANA** (G. P. Lewis) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia olivensana* G. P. Lewis, Kew Bull. 51: 372. 1996. – TYPE: BRAZIL. BAHIA: Municipio de Ilhéus, ca. 9 km along road from Olivença to Maruim, 9 Oct 1989, *A. M. de Carvalho & S. Faria 2554* (holotype: CEPEC; isotype K, NY).

49. SENEGALIA PAINTERI Britton & Rose, N. Amer. Fl. 23: 117. 1928; *Acacia fusicarpa* L. Rico, Acta Bot. Mex. 71: 91. 2005. – TYPE: MEXICO. QUERÉTARO: near Higuerillas, 23 Aug 1905, *J. N. Rose, J. H. Painter, & J. S. Rose 9805* [holotype: NY (MEXU photo); isotype: US, NY]. NOTE: Not to be confused with *Acacia painteri* (Britton & Rose) L. Rico-Arce (2001), which is based on *Acaciella painteri* Britton and Rose (1928). For additional information on these two species see Glass (2003).

50. **SENEGALIA PARAENSIS** (Ducke) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia paraensis* Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 73. 1922. *Manganaroa paraensis* (Ducke) Speg., Physis (Buenos Aires) 6: 312. 1923. – TYPE: BRAZIL. PARÁ: wet clay, often flooded habitat near Itauajury near Montealegre, 24 Apr 1916, *A. Ducke 16050* (lectotype, designated here: MG; isolectotypes: G, RB); [paralectotypes: *A. Ducke 16050, 17141, 10384*].

51. **SENEGALIA PARVICEPS** (Speg.) Seigler & Ebinger, **comb. nov. et stat. nov.** Basionym: *Acacia adhaerens* Benth. var. *parviceps* Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 168. 1921; *Acacia parviceps* (Speg.) Burkart, Legum. Argent. 2nd ed. 542. 1952. – TYPE: ARGENTINA. JUJUY: Sierra Santa Bárbara, Nov 1911, *C. Spegazzini s.n.* (LPS 14309) [lectotype (Cialdella 1984): LP]; [paralectotypes: LPS 14308 (LP), LPS 14311 (LP), and LPS 14310 (LP)]. NOTE: Cialdella (1984) cited the lectotype as being at SI, in reality it is at LP and there is no duplicate at SI (Gutiérrez et al. 2002).

52. **SENEGALIA PEDICELLATA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia pedicellata* Benth., London J. Bot. 1: 522. 1842. – TYPE: BRAZIL. *J. E. Pohl 1440* [holotype: K (NY photo)].

53. SENEGALIA PENINSULARIS Britton & Rose, N. Amer. Fl. 23: 116. 1928; *Acacia peninsularis* (Britton & Rose) Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 11: 158. 1936. – TYPE. MEXICO. BAJA CALIFORNIA SUR: head of Concepción Bay, 6 Apr 1911, *J. N. Rose 16702* [holotype: NY (DS photo, K photo)]. NOTE: Because the name *Senegalia peninsularis* Britton & Rose has been more commonly used for this taxon and is widely accepted, we chose that name for the species, rather than *Senegalia confusa* Britton & Rose. For more information on *Senegalia peninsularis* see Glass (2003).

Senegalia confusa Britton & Rose, N. Amer. Fl. 23: 116. 1928. – TYPE. MEXICO. BAJA CALIFORNIA SUR: La Paz, 14 Jun 1897, *J. N. Rose 1319* (holotype: US). NOTE: The name *Acacia confusa* Merrill (1910), a phyllodinous *Acacia* species from the Philippines, blocked transfer of this specific epithet to *Acacia*.

54. **SENEGALIA PIAUHIENSIS** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia piauhiensis* Benth., in Mart., Fl. bras. 15(2): 397. 1876. – TYPE: BRAZIL. PIAUHÍ: Habitat in silvis catingas et in campis Varedas dictis provinciae Piauhiensis superioris, *Martius 6173* [holotype M (G, MO photos)].

55. SENEGALIA PICACHENSIS (Brandegee) Britton & Rose, N. Amer. Fl. 23: 118. 1928; *Acacia picachensis* Brandegee, Univ. Calif. Publ. Bot. 6: 179. 1915. – TYPE: MEXICO. OAXACA: Cerro Picacho, *C. A. Purpus 7204* [holotype: UC (MEXU photo); isotypes: BM, GH, K, NY].

Acacia chaconensis Miranda, Anales Inst. Biol. Univ. Nac. México 24: 78. (fig. 6). 1953. – TYPE: MEXICO. CHIAPAS: en selvas altas subdeciduas y a veces en matorrales secundarios en La Chacona, unos 8 km. al NO de Tuxtla Gutíerez, alt. 800 m, 24 Jun 1950, *F. Miranda 6407* (lectotype, designated here: MEXU); [paralectotype: *Miranda 7558* (MEXU)].

Senegalia deamii Britton & Rose, N. Amer. Fl. 23: 117. 1928; *Acacia deamii* (Britton & Rose) Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 11: 158. 1936. – TYPE: GUATEMALA. GUALÁN: roadside east of Gualán, alt. 620 ft, 15 Jun 1909, *C. C. Deam 6286* [holotype: NY (MEXU photo); isotypes: F, GH, MICH].

56. **SENEGALIA PIPTADENIOIDES** (G. P. Lewis) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia piptadenioides* G. P. Lewis, Kew Bull. 44: 171. (fig. 1). 1989. – TYPE: BRAZIL. BAHIA: Urucuca to Ubaitaba, Itabuna, 20 Apr 1970, *T. S. dos Santos 746* [holotype: CEPEC (K photo); isotypes: CACAU, CERAC-CEPEC].

57. SENEGALIA PODADENIA Britton & Killip, Phytologia 1: 24. 1933; *Acacia podadenia* (Britton & Killip) Cárdenas, Revista Fac. Agron. (Maracay). 7: 135. 1974. – TYPE: COLOMBIA. BOYACÁ: High thick forest, Mt. Chapón, western Boyacá, alt. 1100 m, 21 Jul 1932, *A. E. Lawrance 346* (holotype: NY; isotypes: BM, F, G, GH, K, LL, MO, US).

58. SENEGALIA POLYPHYLLA (DC.) Britton & Rose, in Britton & Killip, Ann. New York Acad. Sci. 35: 142. 1936; *Acacia polyphylla* DC., Cat. pl. horti monsp. 74. 1813. *Acacia riparia* Bertero ex Spreng., Syst. veg. 3: 142. 1826, nom. illeg. non Kunth (Humboldt et al. 1823); *Acacia fluviatilis* Spreng., Syst. Index. 5: 3. 1828. – TYPE: COLOMBIA. MAGDALENA: Santa Marta, Río Magdalena, 1822,

Balbis s.n. (in herbarium Bertero) [neotype (Pedley, 1986): G-DC (F photo, IAN photo, MO photo, TEX photo); isoneotypes: P, SI]. (IDC. Vol. 2: 218,425.II.8 K)]. NOTE: This specimen is an appropriate neotype because DeCandolle (1825) indicated that the species grows in Santa Marta (Colombia) and cited the specimen: *A. riparia* Bertero!.

Senegalia glomerosa (Benth.) Britton & Rose, N. Amer. Fl. 23: 116. 1928; *Acacia glomerosa* Benth., London J. Bot. 1: 521. 1842. – TYPE: BRAZIL. PIAUHI: Jul-Sep 1839, *G. Gardner 1940* [lectotype (Rico-Arce 2001): K (F, K, MEXU, NY photos); isolectotype: BM, F]. NOTE: Bentham (1842), in addition to the lectotype above, listed two specimens (*A. Guillemin 809, P. Clausen s.n.*).

Senegalia langlassei Britton & Rose, N. Amer. Fl. 23: 116. 1928; *Acacia langlassei* (Britton & Rose) Bullock, Kew Bull. 1939: 2. 1939. – TYPE: MEXICO. GUERRERO: La Botella, 27 Nov 1898, *E. Langlassé 677* [holotype: NY (K photo); isotypes: K, P].

Acacia glomerosa Benth. var. *parviflora* Benth. ex Hemsley, Biol. Cent.-Amer. Bot. 1(4): 353. 1880. – TYPE: PANAMÁ. Empire and Obispo railway stations. *S. Hayes 266 and S. Hayes 330* (syntypes: K).

Leucaena boliviana Rusby., Bull. New York Bot. Gard. 8: 91. 1912. – TYPE: BOLIVIA. LA PAZ: Iturralde, San Buena Ventura, alt. 1500 ft, 29 Nov 1901, *R. S. Williams 356* (holotype: NY).

Acacia amambayensis Hassl., Feddes Repert. Sp. Nov. Regni Veg. 16: 152. 1920. – TYPE: PARAGUAY. AMAMBAY: in altaplanaitie et decliibus, Sierra de Amambay, Sep 1907-1908, *T. Rojas 10602* [holotype: G (F photo); isotypes: BM, K, MO, NY].

Senegalia lobana Britton & Killip, Ann. New York Acad. Sci. 35: 142. 1936. – TYPE: COLOMBIA. BOLÍVAR: San Martín de Loba, Apr-May 1916, *H. M. Curran 55* (holotype: US; isotype: NY fragment).

Acacia aristeguietana L. Cárdenas, Ernstia 2(1-2): 31. 1992. TYPE: VENEZULA: TÁCHIRA: Las Dentas, vía entre Peracaly

Rubio, alt. 1000 m, 25 Sep. 1991 *L. Cárdenas and O. Tapias* 3864 (holotype: MY, isotype: K?). NOTE: Although Cárdenas (1992) notes that the stamens are fused, this fusion appears to be quite weak, possibly caused by the presence of copious dried nectar.

59. **SENEGALIA PRAECOX** (Griseb.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia praecox* Griseb., Abh. Königl. Ges. Wiss. Göttingen. 19: 136. 1874a. – TYPE: ARGENTINA. CÓRDOBA: en el campo, cerca de Córdoba, Sep 1872, *P. G. Lorentz 529* (holotype: GOET; isotypes CORD, K, SI). NOTE: See Cialdella (1984) for discussion of the types. The label of the holotype indicates that the specimen was collected by Lorentz and Hieronymus. Also published in the same year by Grisebach (1874b).

Acacia hassleri Chod. in Chod. & Hassler, Bull. Herb. Boissier. Series 2. 4: 486. 1904; *Acacia praecox* Griseb. f. *hassleri* (Chod.) Burkart, Legum. Argent., 542. 1952. – TYPE: PARAGUAY. CONCEPCIÓN: dumeta formans ad ripam fluminis Paraguay pr. Concepción, Aug 1901-1902, *E. Hassler 7175* [holotype: G (F photo); isotypes: A, K, MO, P, SI].

Acacia praecox Griseb. f. *armata* Speg., Bol. Acad. Nac. Ci. (Córdoba) 26: 209. (pl. 8). 1921. – TYPE: No type cited

Acacia praecox Griseb. f. *inermis* Speg., Bol. Acad. Nac. Ci. (Córdoba) 26: 209. (pl. 8). 1921. – TYPE: No type cited

60. **SENEGALIA PTERIDIFOLIA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia pteridifolia* Benth., London J. Bot. 1: 521. 1842. – TYPE: BRAZIL. RIO DE JANEIRO: *F. Sello 349* (lectotype, designated here: NY; isolectotype: F fragment); [paralectotypes: *J. Lhotsky 1287*; *J. Miers s.n.*]. NOTE: In addition to the lectotype cited above, there was a specimen at B, which was probably destroyed in World War II.

61. SENEGALIA PURPUSII (Brandegee) Britton & Rose, N. Amer. Fl. 23: 114. 1928; *Acacia purpusii* Brandegee, Univ. Calif. Publ. Bot. 3: 380. 1909. – TYPE: MEXICO. PUEBLA: vicinity of San Luis

Tultitlanapa, Jul 1908, *C. A. Purpus 3191* [holotype: UC (MEXU photo); isotypes: BM, F, GH, MO, NY, US]. NOTE: For more information on this species see Glass (2003).

Senegalia rufescens Britton & Rose, N. Amer. Fl. 23: 109. 1928. – TYPE: MEXICO. OAXACA: Cañon del Tomellín, 7 Sep 1906, *Rose & Rose 11344* [holotype: NY (K, MEXU photos); isotype: US].

62. **SENEGALIA QUADRIGLANDULOSA** (Martius) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia quadriglandulosa* Martius, "Herb. fl. bras." Flora 20(2): 110. (Beiblätter). 1837. – TYPE: BRAZIL. in sylvis ad Canto Gallo, prov. Sebastianopolitanae. (holotype: not seen, perhaps at M or BR). NOTE: Martius (1837) suggests that this species is conspecific with *Mimosa plana* Vellozo (1827). The plates of Vellozo cannot be considered as type material because they were made from his drawings after he had died. Apparently no specimens nor his original drawings exist. It is not possible to identify species from Vellozo's drawing and we have placed his name under Excluded Names.

63. **SENEGALIA RECURVA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia recurva* Benth., London J. Bot. 1: 519. 1842. – TYPE: BRAZIL. RIO DE JANEIRO: Organ Mountains, *G. Gardner 359* [holotype: K (F photo, G photo); isotypes: G, P, SI]. NOTE: See Cialdella (1984) for discussion of type.

64. SENEGALIA RENIFORMIS (Benth.) Britton & Rose, N. Amer. Fl. 23: 108. 1928; *Acacia reniformis* Benth., Icon. pl. 12: 59. (pl. 1165). 1876. – TYPE: MEXICO. SAN LUIS POTOSÍ: Las Apuntas, banks of the Río Mostezuma, *C. A. Ehrenberg s.n.* (holotype: B, presumably destroyed). NOTE: Because the plate (Bentham 1876c) is not suitable type material, Glass and Seigler (in review) have designated a neotype for this species.

65. SENEGALIA RIPARIA (Kunth) Britton & Rose ex Britton & Killip, Ann. New York Acad. Sci. 35: 144. 1936; *Acacia riparia* Kunth., in Humb. Bonpl. & Kunth, Nov. gen. sp. 6: 276. (218 in quarto edition). 1823. – TYPE: PERU. ad confluentem fluminis

Amazonum et Chamayae (Provincia Jaen de Bracamores), alt. 225 hex., *Humboldt & Bonpland s.n.* (holotype: P or B-Willd.). NOTE: The type was not located among Kunth materials in herbaria P or B-Willd by the first author in 1992. However, Bentham (1875) noted that, "Kunth's specimen in the Paris Herbarium belongs to a form with rather small and narrow leaflets".

NOTE 2: In response to the recent conservation of the type for *Acacia* with an Australian species, and both the desirability and timeliness of transferring species of the former subgenus *Aculeiferum* to the genus *Senegalia*, the fact that the name *Acacia riparia* Kunth has been used for this widespread species by most workers and that name is widely employed in floras of both Latin America and the United States, and in order to contribute to nomenclatural stability, we have made a proposal to conserve the name *Acacia riparia* Kunth in Humboldt et al. (1823). If accepted, the name for this taxon must become *Senegalia riparia* (Kunth) Britton & Rose.

Acacia retusa (Jacq.) Howard, J. Arnold Arbor. 54: 435. 1973. *Mimosa retusa* Jacq., Enum. syst. pl. 34. 1760. – TYPE: none designated. NOTE: The original description (Jacquin 1760) indicates that only a leaf fragment was used to describe this species. This fragment is probably a specimen at BM. According to Rudd (1976), a fruit was formerly associated with the specimen and the fruit is mentioned in a later description (Jacquin 1763). The specimen at BM came from Cartagena, Colombia. Neither description (Jacquin 1760, 1763) is adequate to identify the species being described. With the materials available, we are unable to determine the status of the specimen from BM. In the future, if adequate type material is located and this taxon is judged conspecific with *Senegalia riparia*, the name *Mimosa retusa* Jacq. will replace *Acacia riparia* Kunth as the basionym for this species.

Rudd (1976) located a specimen of *Mimosa carthagenensis* P. Miller ex auct. (1809), collected by Dr. Houstoun at Carthagena, Colombia, with both flowers and fruit at BM. Based on the illustration from the article, she felt that this taxon was conspecific with *A. retusa*.

Mimosa sarmentosa Persoon, Syn. pl. 2: 266. 1807; *Mimosa sarmentosa* Desf., Tabl. ecole bot. 181. 1804, nom. invalid. (nom.

nud.); *Acacia sarmentosa* Desv., Jour. Bot. 3: 70. 1814. – TYPE: no type cited. NOTE: Desvaux (1814) cites both Desfontaines (1804) and Persoon (1807). Priority for nomenclature begins with Persoon (1807). Persoon notes that this was a cultivated plant; Desvaux (1814) states that the plant was "cultivée dans le Jardin des Plantes", suggesting that the material studied by all three investigators was in the botanic garden in Paris, as all three lived there during this period.

Mimosa paniculata West, Bidr. Beskr. Ste Croix 312. 1793, nom. nud.; *Mimosa paniculata* West ex Vahl, Eclog. amer. 3: 39. 1807, nom. illeg., non *Mimosa paniculata* J. C. Wendland (1798) nec *Mimosa paniculata* (Willd.) Poiret (1810); *Acacia westiana* DC., Prod. 2: 464. 1825; *Senegalia westiana* (DC) Britton & Rose, N. Amer. Fl. 23: 119. 1928. – TYPE: VIRGIN ISLANDS. Habitat in insula St. Crucis. *West s.n.* (holotype: not seen). NOTE: *Mimosa paniculata* J. C. Wendland (1798) is a species from the South Sea Islands. Although West (1793) refers to Vahl (1794), no other information is given. Interestingly, Vahl does not include *Mimosa paniculata* in his publication.

Mimosa sarmentosa Sessé & Moc. Pl. nov. Hispan. 257. 1887. – TYPE: Habitat prope rivulos inter montium Tepalcatepec a Coahuayana separantium anfractus profluentes. NOTE: No type cited.

Acacia riparia Kunth var. *angustifoliola* Kuntze, Revis. gen. pl. 3: 47. 1898. – TYPE: BOLIVIA. SANTA CRUZ: Sierra de Santa Cruz, 2000 m, *O. Kuntze s.n.* (holotype: NY; isotype F).

Acacia riparia Kunth var. *media* Kuntze, Revis. gen. pl. 3: 47. 1898. – TYPE: BOLIVIA. Yapacani, 400 m, *O. Kuntze s.n.* (holotype: NY?).

Acacia riparia Kunth var. *latifolia* Kuntze, Revis. gen. pl. 3: 47. 1898. – TYPE: BRAZIL. MATO GROSSO: *O. Kuntze s.n.* (holotype: NY?).

Acacia pseudo-adhaerens Hassl., Feddes Repert. Spec. Nov. Regni Veg. 8: 554. 1910; *Acacia riparia* Kunth var. *pseudo-adhaerens*

(Hassl.) Hassl., Feddes Rep. Sp. Nov. Regni Veg. 16: 153. 1920. – TYPE: PARAGUAY. In dumetis ad flumen Apa, Jun 1886. *E. Hassler 163* (holotype: G).

Acacia riparia Kunth f. *intermedia* Hassl., Feddes Repert. Sp. Nov. Regni Veg. 16: 153. 1920. – TYPE: PARAGUAY. In dumetis pr. Ita, Sep, *E. Hassler 1154* (holotype: G).

Acacia quadricostata Britton, Bull. Torrey Bot. Club. 48: 332. 1921. – TYPE: TRINIDAD. Hillside, Chacachacare Island, 3 Apr 1921, *N. L. Britton, Freeman, Watts 2685* (holotype: NY).

Acacia riparia Kunth var. *multijuga* Ducke, Arch. Jard. Bot. Rio de Janeiro 4: 32. 1925. – TYPE: BRAZIL. PARÁ: habitat on the flooded shores of the river Tapajóz at Miritituba, near Itaituba, 28 May 1923, *A. Ducke 16801* (holotype: RB).

Senegalia guadalupensis (DC.) Britton & Rose, N. Amer. Fl. 23: 119. 1928; *Acacia guadalupensis* DC., Prod. 2: 464. 1825. – TYPE: GUADELOUPE. *Bertero s.n.* [holotype: G (F photo)].

Senegalia acapulcensis Britton & Rose, N. Amer. Fl. 23: 119. 1928. – TYPE: MEXICO. GUERRERO: in arenosis vicinity of Acapulco, Oct 1894 – Mar 1895, *E. J. Palmer 624* [holotype: NY (MEXU photo, MO photo, P photo); isotype: A]. NOTE: Not *Acacia acapulcensis* Kunth in Humboldt et al. (1823), which is *Lysiloma acapulcensis* (Kunth) Bentham (1842).

Senegalia ortegae Britton & Rose, N. Amer. Fl. 23: 119. 1928; *Acacia ortegae* (Britton & Rose) Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 11: 158. 1936. – TYPE: MEXICO. SINALOA: roadside in the vicinity of Villa Unión, 2 Apr 1910, *J. N. Rose, P. C. Standley & P. G. Russell 13902* (holotype: US; isotype: NY).

Senegalia potosina Britton & Rose, N. Amer. Fl. 23: 119. 1928; *Acacia potosina* (Britton & Rose) E. Matuda M., Las Leguminosas del Estado de México. Dirección Recursos Naturales. No. 272: 17. 1981. – TYPE: MEXICO. SAN LUIS POTOSÍ: lowland forests near Las

Palmas, 24 Jul 1891, *C. G. Pringle 3782* [holotype: NY (F photo, MO photo); isotypes: BM, F, G, JE, K, MEXU, MIN, MO, MU, P, US].

Senegalia riparioides Britton & Rose, N. Amer. Fl. 23: 117. 1928; *Acacia riparioides* (Britton & Rose) Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 3: 277. 1930. – TYPE: EL SALVADOR. Ahuachapán, Jan 1922, *P. C. Standley 19848* [holotype: NY (MEXU photo); isotypes: F, G, G-DC, GH, US].

Senegalia cundinamarcae Britton & Killip, Ann. New York Acad. Sci. 35: 143. 1936; *Acacia cundinamarcae* (Britton & Killip) García-Barriga & Forrero G., Cat. Il. Pl. Cundinamarca 3: 19. 1968. – TYPE: COLOMBIA. CUNDINAMARCA: Girardot, alt 350-400 m, 19 Jul 1917, *H. H. Rusby & F. W. Pennell 133* (holotype: NY; isotypes: GH, US). NOTE: Britton & Killip (1936) designate *H. H. Rusby & F. W. Pennell 133* as the type, but they also list *H. H. Rusby & F. W. Pennell 1246* as an additional collection.

Senegalia eliasiana Britton & Killip, Ann. New York Acad. Sci. 35: 145. 1936; *Acacia eliasiana* (Britton & Killip) Standl., Trop. Woods 52: 27. 1937. – TYPE: COLOMBIA. ATLÁNTICO: Baranoa, Barranquilla, Nov 1928, *Bro. Elias 602* (holotype: US; isotypes: NY fragment, US). NOTE: Standley (1937) published this as *Acacia eliasana*, a spelling error.

Senegalia huilana Britton & Killip, Ann. New York Acad. Sci. 35: 144. 1936; *Acacia huilana* (Britton & Killip) García-Barriga & Forrero, Cat. Il. Pl. Cundinamarca 3: 21. 1968. – TYPE: COLOMBIA. HUILA: plain between Río Cabrera and Villavieja, 26 Jul 1917, alt. 500-550 m, *H. H. Rusby & F. W. Pennell 365* (lectotype, designated here: NY; isolectotype: GH, US); [paralectotypes: *H. H. Rusby & F. W. Pennell 378* (NY?).

Senegalia affinis Britton & Killip, Ann. New York Acad. Sci. 35: 144. 1936. – TYPE: COLOMBIA. MAGDALENA: Santa Marta, Guamacito, 15 Jan 1930, *S. J. Record 21* (holotype: NY; isotypes: F, GH, US fragment).

66. SENEGALIA ROEMERIANA (Scheele) Britton & Rose, N. Amer. Fl. 23: 115. 1928; *Acacia roemeriana* Scheele, Linnaea 21: 456. 1848. – TYPE: UNITED STATES. TEXAS: near Austin, Apr 1847, *F. Römer s.n.* (holotype: B, destroyed). NOTE: For more information on this species and its synonyms, see Glass (2003) and Glass and Seigler (in review).

Senegalia lozanoi Britton & Rose ["lozanii"], N. Amer. Fl. 23: 115. 1928. – TYPE: MEXICO. NUEVO LEÓN: Sierra Madre above Monterrey, alt. 2800 ft., 29 Mar 1906, *C. G. Pringle 10216* (holotype: VT; isotypes: CAL, F, G, K, MEXU, MO, MSC, NY). NOTE: The spelling of this name should be modified because it probably commemorates Filemon Lozano, Pringle's collecting partner [See Art. 60, Rec. 60C.1(a)]. Pringle's diary (Davis 1936) indicates that Lozano was with him when the specimen was collected.

Senegalia malacophylla Britton & Rose, N. Amer. Fl. 23: 115. 1928; *Acacia malacophylla* Benth. in A. Gray, Pl. wright. 1: 64. 1852, nom. illeg. – TYPE: UNITED STATES. TEXAS: uplands of the Leona, western Texas, Jun 1849, *C. Wright 172* [holotype: GH; isotypes: K, NY (NY photo), US]. NOTE: A lectotype is being designated in Glass and Seigler (in review). Not *Acacia malacophylla* Steud. ex A. Richard (1847), an Ethiopian species.

Senegalia saltilloensis Britton & Rose, N. Amer. Fl. 23: 115. 1928. – TYPE: MEXICO. COAHUILA: near Saltillo, May 1898, *E. J. Palmer 169* [holotype: NY (GH photo, K photo, MEXU photo, NY photo); isotypes: A, BM, F, GH, K, MEXU, US].

Senegalia palmeri (S. Watson) Britton & Rose, N. Amer. Fl. 23: 115. 1928; *Acacia palmeri* S. Watson, Proc. Amer. Acad. Arts 17: 350. 1882. – TYPE: MEXICO. COAHUILA: Sierra Madre S of Saltillo, 22-30 Mar 1880, *E. J. Palmer 298* [holotype: GH (F, MEXU, NY photos); isotypes: F, GH, K, P, US].

67. **SENEGALIA ROSTRATA** (Humb. & Bonpl. ex Willd.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia rostrata* Humb. & Bonpl. ex Willd., Sp. pl. 4: 1060. 1806; *Mimosa rostrata* (Humb. & Bonpl. ex

Willd.) Poir. in Lam. Encyc. Suppl. 1: 66. 1810; *Lysiloma rostrata* (Willd.) Benth., London J. Bot. 3: 84. 1844; *Dugandia rostrata* (Willd.) Britton & Killip, Ann. New York Acad. Sci. 35: 138. 1936. – TYPE: Habitat in America meridionali, *Humboldt & Bonpland s.n.* (holotype: B-Willd.). NOTE: According to Humboldt et al. (1823) the type was from the Magdalena River, Colombia.

Mimosa ignava Kunth in Humboldt, Bonpl. & Kunth. Nov. gen. sp. 6: 259. 1823. – TYPE: COLOMBIA. MAGDALENA: crescit ad fluvium Magdalenae, prope Teneriffe, *Humboldt & Bonpland s.n.* (holotype: B-Willd.; isotype: P- HBK).

Acacia articulata Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 73. 1922; *Manganaroa articulata* (Ducke) Speg., Physis (Buenos Aires). 6: 312. 1923. – TYPE: BRAZIL. PARÁ: on periodically flooded shores of the Gurupatuba River near Montealegre, 23 Apr 1916, *Ducke 16038* [lectotype, designated here: RB (F photo); isolectotypes: BM, G, P]; [paralectotype: *A. Ducke 16494*].

68. **SENEGALIA RURRENABAQUEANA** (Rusby) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia rurrenabaqueana* Rusby, Mem. New York Bot. Gard. 7: 255. 1927. – TYPE: BOLIVIA. Rurrenabaque, alt. 1000 ft., 25 Jan 1922, *O. E. White 2043* (holotype: NY; isotypes: GH, US).

69. **SENEGALIA SANTOSII** (G. P. Lewis) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia santosii* G. P. Lewis, Kew Bull. 51: 371. 1996. – TYPE: BRAZIL. BAHIA: 10-15 km along road Conquista to Anagé Catinga, 22 Nov 1972, *dos Santos 2488* (holotype: CEPEC; isotype: K).

70. **SENEGALIA SCANDENS** Seigler & Ebinger, **nom. nov.** *Acacia scandens* Willd., Enum. pl. 1057. 1809, nom. illeg., non Willdenow (1806). – TYPE: BRAZIL. *Comes de Hoffmannsegg* (holotype: B-Willd.). NOTE: The species described as *A. scandens* by Willdenow (1806) is referable to the genus *Entada* (Steudel 1841).

71. **SENEGALIA SERRA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia serra* Benth., London J. Bot. 1: 519. 1842. – TYPE: BRAZIL. RIO DE JANEIRO: Barnha da Bacalhao, Apr 1822, *F. Sello 890* [holotype: B, presumably destroyed (G photo); isotypes: F, K, MO, NY].

72. SENEGALIA SORORIA (Standl.) Britton & Rose, N. Amer. Fl. 23: 108. 1928; *Acacia sororia* Standl., Contr. U. S. Natl. Herb. 20: 186. 1919. – TYPE: MEXICO. QUERÉTARO: between Visarón and Higuerillas, 23 Aug 1905, *J. N. Rose, J. H. Painter, & J. S. Rose 9761* [holotype: US (MEXU photo); isotype: NY]. NOTE: This taxon is probably a hybrid between *A. reniformis* and *A. berlandieri*, according to Glass (2003).

73. SENEGALIA SUBANGULATA (Rose) Britton & Rose, N. Amer. Fl. 23: 109. 1928; *Acacia subangulata* Rose, Contr. U. S. Natl. Herb. 5: 194. 1899. – TYPE: MEXICO. PUEBLA: limestone hills near Tehuacán, alt. 5000 ft, 6 Aug 1897, *C. G. Pringle 6775* [holotype: US (MEXU photo); isotypes: CM, ENCB, F, GH, JE, JEPS, K, MEXU, MO, NY, UC]. NOTE: For additional information see Glass (2003).

74. SENEGALIA SUBSESSILIS Britton & Rose, N. Amer. Fl. 23: 117. 1928; *Acacia amabilis* L. Rico, Acta Bot. Mex. 71: 91. 2005. – TYPE: MEXICO. HIDALGO: Ixmiquilpan, 1905, *J. N. Rose, J. H. Painter, & J. S. Rose 8926* [holotype: US (MEXU photo, NY photo); isotypes: K, NY fragment]. NOTE: The name *Acacia subsessilis* Chapman and Maslin (1999), an Australian species with phyllodes, blocked transfer of the specific epithet to *Acacia*. For additional information see Glass (2003).

75. SENEGALIA TAMARINDIFOLIA (L.) Britton & Rose, N. Amer. Fl. 23: 120. 1928; *Mimosa tamarindifolia* L., Sp. pl. 1: 523. 1753; *Acacia tamarindifolia* (L.) Willd., Sp. pl. 4: 1092. 1806; *Acacia pinnata* Link, Enum. hort. berol. alt. 2: 446. 1822. – TYPE: habitat in America meridiionalis [holotype: tab. 7 in Plumier (1755)].

Senegalia grenadensis Britton & Rose, N. Amer. Fl. 23: 120. 1928. – TYPE: GRENADA. Point Saline, 17 Jul 1905, *W. E. Broadway 1808* (holotype: US).

76. SENEGALIA TENUIFOLIA (L.) Britton & Rose, N. Amer. Fl. 23: 118. 1928. *Mimosa tenuifolia* L., Sp. pl. 1: 523. 1753; *Acacia tenuifolia* (L.) Willd., Sp. pl. 4: 1091. 1806. – TYPE: Habitat in America calidiori [lectotype, designated here: tab. 17 of Plumier (1755)]. NOTE: According to Grimes (1992), tab. 17 of Plumier was not published but was seen by Linnaeus. Grimes did not formally lectotypify the name. This plate is located in the Codex Boerhavianus in the library of the Rijksuniversiteit Groningen.

Senegalia paniculata (Willd.) Killip ex Record, Trop. Woods. 63: 6. 1940; *Acacia paniculata* Willd., Sp. pl. 4: 1074. 1806, non J. F. Macbride (1919); *Mimosa paniculata* (Willd.) Poir., in Lamarck, Encycl. Suppl. 1: 74-75. #173. 1810, non Vahl (1807); *Manganaroa paniculata* (Willd.) Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 239. 1921. – TYPE: BRAZIL. PARÁ: *Comes de Hoffmansegg* [lectotype, Grimes (1992): B-Willd. (microfiche IDC. 1389. I. 8) (Willd. Cat. No. 19157) (F photo)]. NOTE: There are two specimens with Cat. No. 19157, both from Hoffmansegg. Grimes (1992) lectotypified *A. paniculata* based on the flowering specimen; the fruiting specimen is a member of the genus *Anadenanthera*.

Acacia julibrissin Sieb. ex Martius, "Herb. fl. bras." Flora 20(2): 109. (Beiblätter). 1837, non Willdenow (1806) nec *Albizzia julibrissin* Durazzini (1772). TYPE: No type cited.

Acacia clausseni Benth., London J. Bot. 1: 518. 1842. – TYPE: BRAZIL. PIAUHÍ: near Crato, *G. Gardner 1941* [lectotype, designated here: K); [paralectotypes: Rio San Francisco, *P. Clausen, F. Sello s.n., G. Gardner 1821, G. Gardner 1941*].

Acacia grandisiliqua (Vell.) Benth., London J. Bot. 1: 518. 1842; *Mimosa grandisiliqua* Vell., Fl. flum. 11: (t. 37). 1827. – TYPE: none designated. NOTE: The plates of Vellozo cannot be considered as type material because they were made from his drawings after he

had died. Apparently no specimens nor his original drawings exist. Bentham (1875, 1876a) considered *Acacia grandisiliqua* to be conspecific with *Acacia tenuifolia*, a view with which we concur.

Acacia martinicensis K. Presl., Abh. Königl. Böhm. Ges. Wiss. Series 5. 3: 495. 1845. – TYPE: MARTINIQUE. *Kohaut s.n.* (holotype: not seen).

Acacia microcephala A. Rich., A. Rich in Sagra, Hist. Phys. Cuba, Pl. vasc. 4: 469. 1845, nom. illeg., non Graham ex Wallich (1828) nec Macfadyen (1837). – TYPE: CUBA. Circa Guara, *Ramon de la Sagra s.n.* (holotype: P: isotype: K). NOTE: *Acacia microcephala* Wallich (1828) is an Asian species, whereas *Acacia microcephala* Macfadyen (1837) is synonymous with *Vachellia macracantha* (Kunth) Seigler & Ebinger (2005).

Acacia incerta Hoene, Relat. Commiss. Linhas Telegr. Estrateg. Matto Grosso Amazonas. 5(8): 22. (pl. 135). 1919. – TYPE: BRAZIL. MATTOGROSSO: em Copipo da ponte, Cuyaba, *F. C. Hoehne 2534* and *2535* (syntypes: SP?).

Acacia stenocarpa Malme, Ark. Bot. 23A: 46. 1931, non Hochst. ex Richard (1847). – TYPE: BRAZIL. MATO GROSSO: Corumbá, in silva satis clara regionis calcariae, 19 Dec 1902, *G. O. A. Malme 2731* (lectotype, designated here: S) [paralectotype: *Malme 2731a* (S)]. NOTE: *Acacia stenocarpa* Hochst. ex A. Richard (1847) is referable to an African species of the genus *Vachellia*.

Senegalia turbacensis Britton & Killip, Ann. New York Acad. Sci. 35: 146. 1936. – TYPE: COLOMBIA. BOLÍVAR: thicket, vicinity of Turbaco, alt. 200-300 m, 14 Nov 1926, *E. P. Killip and Smith 14482* (holotype: NY; isotypes: A, GH, US).

Acacia tenuifolia (L.) Willd. var. *veraensis* Kitanov, Ann. Univ. Sofia Fac. Biol. 64(2): 60. 1972. – TYPE: CUBA. "1969/1970", *Kitanov s. n.* (holotype: not seen).

77. **SENEGALIA TENUIFOLIA** (L.) Britton & Rose var. **PRODUCTA** (Grimes) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia tenuifolia* (L.) Willd. var. *producta* Grimes, Brittonia 44: 267. 1992. – TYPE: SURINAM. Common in riverine forest, 2-10 km below confluences with Oost River, Lucie River, alt. 225 m, 4 Sep 1963, *H. S. Irwin, G. T. Prance, T. R. Soderstrom, and N. Holmgren 55373* (holotype: NY).

SENEGALIA TENUIFOLIA (L.) Britton & Rose var. **TENUIFOLIA**

78. **SENEGALIA TRIJUGA** (Rizzini) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia trijuga* Rizzini, Rodriguésia 28(41): 166. 1976. – TYPE: BRAZIL. PIAUÍ: caatinga ad São Raimundo Nonató, Fazenda Vereda, 21 Sep 1973, *D. P. Lima 13232* (holotype: RB).

79. **SENEGALIA TUBULIFERA** (Benth.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia tubulifera* Benth., London J. Bot. 1: 520. 1842. – TYPE: PERU. 1835, *Mathews 1568* (holotype: K).

Acacia rynchocarpa Rusby, Bull. New York Bot. Gard. 8: 90. 1912. – TYPE: BOLIVIA. Apolo, alt. 4800 ft., 2 Jul 1902, *R. S. Williams* 1508 [holotype: NY (K photo, MEXU photo, NY photo); isotypes: BM].

80. **SENEGALIA TUCUMANENSIS** (Griseb.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia tucumanensis* Griseb., Pl. Lorentz. 87. 1874a. – TYPE: ARGENTINA. TUCUMÁN: Siambón, Sierra de Tucumán, Mar 1872, *P. G. Lorentz 737* [lectotype (Burkart 1979): GOET; isolectotypes: CORD, SI]; [paralectotype: *P. G. Lorentz 220*]. NOTE: Published at nearly the same time in Grisebach (1874b). See Cialdella (1984) for more information on types.

Acacia tucumanensis Griseb. var. *subscandens* Griseb., Pl. Lorentz. 87. 1874a; *Acacia riparia* Kunth var. *subscandens* (Griseb.) Griseb. Symb. fl. argent. 122. 1879b. – TYPE: ARGENTINA. TUCUMÁN: Juntas, Sierra de Tucumán, 21 Mar 1872, *P. G. Lorentz 101* (holotype: GOET; isotype: CORD, SI). NOTE: Published at

nearly the same time in Grisebach (1874a). See Cialdella (1984, 1997) for additional information concerning the type.

Acacia riparia Kunth var. *tucumanensis* Griseb., Symb. fl. argent. 121. 1879b. – TYPE: ARGENTINA. TUCUMÁN: Siambón, Sierra de Tucumán, Mar 1872, *P. G. Lorentz 268* [holotype: GOET; isotypes CORD, K, SI]. NOTE: Published at nearly the same time in Grisebach (1879a).

Acacia riparia Kunth var. *argentinensis* Speg., Bol. Acad. Nac. Ci. (Córdoba) 26: 220. (pl. 221, 223). 1921. – TYPE: ARGENTINA. No type cited. NOTE: We have followed Cialdella (1984, 1997) in regarding this name as a synonym of *Acacia tucumanenis* Griseb.

81. **SENEGALIA VELUTINA** (DC.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia velutina* DC., Prod. 2: 459. 1825; *Manganaroa velutina* (DC.) Speg., Bol. Acad. Nac. Ci. (Córdoba) 26: 272. 1921. – TYPE: BRAZIL. RIO DE JANEIRO: [holotype: G (F photo, MO photo, SI photo); isotype: G].

Acacia velutina DC. var. *monadena* Hassl., Feddes Repert. Spec. Nov. Regni Veg. 16: 153. 1920. – TYPE: No type cited.

Acacia velutina DC. var. *monadena* Hassl. f. *inermis* Hassl., Feddes Repert. Spec. Nov. Regni Veg. 16: 154. 1920. – TYPE: PARAGUAY. No type cited.

Acacia velutina DC. var. *monadena* Hassl. f. *ferox* Hassl., Feddes Repert. Sp. Nov. Regni Veg. 16: 153. 1920. – TYPE: PARAGUAY. In altoplinitie et decliviis Sierra de Maracayú, 1898-1900, *E. Hassler 5347* (holotype: G?; isotype: K).

Manganaroa velutina (DC.) Speg. var. *glabrescens* Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 272. 1921; *Acacia velutina* DC. var. *glabrescens* (Speg.) Burkart, Legum. Argent., ed. 2: 541. 1952. – TYPE: ARGENTINA. MISIONES: Campo de las Cuyas, Feb. 1907, *K. Fiebrig 6229* (LPS 10410) [lectotype: (Burkart 1979): LP]. NOTE: There are two sheets in the folder, both with the same numbers. One of

them was designated as the lectotype by Burkart (1979). See Gutiérrez et al. (2002) for more information on the types.

82. **SENEGALIA VISCO** (Lorentz ex Griseb.) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia visco* Lorentz ex Griseb., Pl. Lorentz. 87. 1874b (as *Acacia visite*). – TYPE: ARGENTINA. CATAMARCA: Fuerte de Andalgalá ad rivulos, 13 Jan 1872, *P. G. Lorentz 269* (holotype: unknown; isotypes: CORD, SI). NOTE: Grisebach (1879a) indicated that he emended an earlier species description and replaced the name *Acacia visite* with *Acacia visco* Lorentz ex Grisebach (1874a,b)

Acacia concinna Philippi, Anales Univ. Chile 36. 2: 170. 1870, nom. illeg., non DeCandolle (1825). – TYPE: ARGENTINA. Mendoza, *in hortis*, *Philippi s.n.* [holotype: SGO (SI photo); isotypes: SI fragment). NOTE: *Acacia concinna* DeCandolle (1825) is a species of *Senegalia* from the East Indies.

Acacia polyphylla Clos. in Gay, Fl. Chil. 2: 254. 1846. non DeCandolle (1813). *Lysiloma polyphylla* (Clos) Benth., Trans. Linn. Soc. London 30: 535. 1875. – TYPE: CHILE. Pcia. Coquimbo, San Isidro, 1836, *an culta* (holotype: SGO; isotypes: SI fragment).

Acacia platensis Mang., Anales Soc. Ci. Argent. 87: 128. (fig. 12, 13). 1919; *Manganaroa platensis* (Mang.) Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 254. 1921. – TYPE: No type cited. NOTE: According to Cialdella (1984), a type is available at LP, but we found no specimen cited in Manganaro (1919).

Manganaroa subsericea Speg., Bol. Acad. Nac. Ci. (Córdoba). 26: 267. 1921. – TYPE: ARGENTINA. SALTA: In dumetis montanis praeandinis, locis Quebrada de Guachipas et Pampa grande vocatis, *C. L. Spegazzini s.n.* (LPS 14305) [lectotype, here designated: LP]; [paralectotype: Prov. Buenos Aires, La Plata, Jardín Botánico "Facultad de Agron.", *C. Spegazzini s.n.* (LPS 14304) (LP)]. NOTE: See Cialdella (1984, 1997) and Gutiérrez et al. (2002) for further information on the type. In the opinion of the latter authors, both specimens may represent the same accession of plant material.

83. SENEGALIA VOGELIANA (Steud.) Britton & Rose, N. Amer. Fl. 23: 116. 1928. *Acacia vogeliana* Steud., Nomencl. bot. 2: 1: 9. 1840. *Lysiloma vogeliana* (Britton & Rose) Stehlé, Bull. Mus. Hist. Nat. Paris. Ser. 18: 193. 1946. – TYPE: HAITI: Santo Domingo, 1839, *C. A. Ehrenberg s.n.* [holotype: B, destroyed (K photo); lectotype: designated here: NY; isotype: US fragment). NOTE: Most recent workers do not consider this species to be a member of the genus *Lysiloma* (Barneby and Zanoni, 1989; Barneby and Grimes, 1996). Howard (1988), in contrast, placed the name *Acacia vogeliana* Steudel in synonymy under *Lysiloma ambigua* Urban. In contrast to other *Lysiloma* species, which possess extended monadelphous filament tubes, the filaments of the stamens are at most very shortly united at the base, a characteristic of many *Acacia* species.

Acacia ambigua Vogel, Linnaea 10: 600. 1836, nom. illeg., non Hoffmannsegg (1826). *Lysiloma ambigua* Urban, Ark. Bot. 22A(8): 28. 1928. – TYPE: HAITI. S. Domingo, Plaine prés de Port-au-Prince, 1828-1831, *C. A. Ehrenberg 274* [holotype: B, destroyed; lectotype: here designated: HAL (K photo)].

84. **SENEGALIA WEBERBAUERI** (Harms) Seigler & Ebinger, **comb. nov.** Basionym: *Acacia weberbaueri* Harms., Feddes Repert. Sp. Nov. Regni Veg. 16: 351. 1920. – TYPE: PERU. CAJAMARCA: Prov. Jaén, between Jaén and Bellavista, Apr 1912, *A. Weberbauer 6209* [holotype: B, destroyed (F photo); isotypes: F, MO, US].

85. SENEGALIA WRIGHTII (Benth.) Britton & Rose, N. Amer. Fl. 23: 110. 1928; *Acacia wrightii* Benth. in A. Gray, Pl. wright. 1: 64. 1852; *Acacia greggii* A. Gray var. *wrightii* (Benth.) Isely, Sida 3: 378. 1969. – TYPE: UNITED STATES. TEXAS: Expedition from Western Texas to El Paso, New Mexico, hills of Rio Grande and east to San Antonio, May-Oct 1849, *C. Wright 173* (holotype: GH, isotype NY, US). NOTE: See Isely (1969, 1973, 1998) and Glass (2003) for more information on the types.

NAME IN PRESS

Acacia kelloggiana A. M. Carter & Rudd, Madroño 28: 221. (figs. 1-2). 1981. – TYPE: MEXICO. BAJA CALIFORNIA SUR, Sierra de la Giganta, vicinity of La Matancita, alt. 690-750 m, 13 Oct 1966, A. M. *Carter and M. Sousa 5152* (holotype: UC; isotypes: BM, MEXU, US). NOTE: For more information on this species see Glass (2003). This species is in the process of being transferred to the genus *Senegalia* (Glass and Seigler in review).

INCERTAE SEDIS

Only names that appear to be referable to *Senegalia* are considered here:

Acacia intsioides DC., Prod. 2: 464. 1825. Neither the fruit or the country of origin of this taxon is known; we have excluded it from American *Senegalia*. This is probably an Asian species of *Senegalia*.

Acacia oligophylla Hoffsgg., Verz. Pfl.-Kult. Suppl. 201. (#106). 1826. *Acacia oligophylla* Hoffsgg. ex DC. Prod. 2: 471. 1825. This name was published by Hoffmannsegg (1826) and cited in De Candolle (1825) as Hoffmannsegg (1824). We exclude this taxon because of doubts about the identity of the species (Bentham 1842, p. 523), because no type is cited or known to be extant, and the origin of the material is vague.

Acacia plumosa Lowe, Bot. Mag., n. s. 8: (tab. 3366). Nov. 1834. nom. illeg. non *A. plumosa* Mart. ex Colla (1834). – TYPE: no type cited. NOTE: Probably from Brazil, but described from a specimen cultivated in Madeira. Not *Acacia plumosa* Martius ex Colla (1834), which was published in July 1834, making Lowe's name (Lowe 1834), which was published in November 1834, a later homonym in the genus *Acacia*.

Acacia plumosa Martius ex Colla, Herb. Pedemont. 2: 267. 1834. – TYPE: BRAZIL. Villa Nova. [holotype: no type cited]. NOTE: Based on the description this taxon is referable to the genus *Senegalia*.

Location of type materials will be required to determine the status of this species.

EXCLUDED NAMES

Mimosa fluminensis Vell., Fl. flumin. 11: 55. (t. 38). 1827; *Mimosa paratyensis* Vell., Fl. flumin. 11: 60. (pl. 41). 1827; *Mimosa plana* Vell., Fl. flumin. 11: 111. tab. 28 (not tab. 10). 1827; and *Mimosa quadrangularis* Vell., Fl. flumin. 11: (t. 36). 1827. These taxa are probably *Senegalia* species, but it is not possible to identify them with certainty from Vellozo's plates. In any case, the plates of Vellozo cannot be considered as type material because they were made from his drawings after he had died. Apparently no specimens nor his original drawings exist.

Senegalia striata (Humb. & Bonpl. ex Willd.) Pittier, Supl. Pl. Usual. Venez. 36. 1939; *Acacia striata* Humb. & Bonpl. ex Willd., Sp. Pl. 4(2): 1089. 1806, described from America meridionali by Willdenow (holotype: B-Willd.) and often attributed to *Senegalia*, does not, in our judgement, belong to that genus.

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Appendix 1. Species used in this study. Genbank numbers are for the *mat*K and *trn*L chloroplast DNA regions. Provisional names used for taxa that may be referred to *Vachellia* or *Senegalia* in future studies have been given in parentheses.

Genus	Species	Voucher/ Collector	Genbank
Acacia	*lycopodiifolia*	CANB 615616	DQ371879
Acacia	*mearnsii*	CANB 615612	AF523110
Acacia	*melanoxylon*	CANB 615580	AF274166, AF195699, AF195680
Acacia	*galpinii*	CANB 615736	AF523098, AF522988
Acacia	*visco*	CANB 615607	AF523116, AF522982
"*Acacia*"	*angustissima*	DS15993	DQ371887, DQ371872
"*Acacia*"	*boliviana*	CANB 615555	AF274144
"*Acacia*"	*glauca*	DLEG96-02580	DQ371880, DQ371857
"*Mariosousa*"	*coulteri*	DS15953	DQ371893, DQ371868
"*Mariosousa*"	*dolichostachya*	DS16035	DQ371892, DQ371866
"*Mariosousa*"	salazari	DS15978	DQ371888, DQ371865
"*Mariosousa*"	usumacintensis	DS16025	DQ371889, DQ371863
"*Mariosousa*"	willardiana	DLEG 89-0143	AY386898, DQ371862
Senegalia	berlandieri	CANB 615596	AF274145, AF522978
Senegalia	gilliesii	DLEG94-0167	DQ371882, DQ371860
Senegalia	picachensis	DS16042	DQ371895, DQ371858
Senegalia	picachensis	DS15981	DQ371885, DQ371871
Senegalia	polyphylla	DELEP 910150	AF274147, AF522980
Senegalia	roemeriana	CANB 615608	AF523099, AF522977
Senegalia	sororia	DS16067	DQ371876, DQ371859

Senegalia	wrightii	DLEG 900444	AF274148, DQ371854
"Senegalia"	catechu	CANB 615594	AF274141, DQ371870
"Senegalia"	erubescens	CANB 61573	AF523185, AF523109
"Senegalia"	*macrostachya*	CANB 632225	DQ371881, DQ371856
"Senegalia"	*modesta*	CANB 615595	AF274142, AF522975
"Vachellia"	*nilotica*	CANB 615592	AF274139, AF522973
"Senegalia"	*schweinfurthii*	CANB 615609	AF523101, AF522979
"Senegalia"	*senegal*	CANB 615554	AF274143, AF195700, AF195681
Vachellia	*collinsii*	DS16041	DQ371884, DQ371869
Vachellia	*constricta*	DS16061	DQ371883, DQ371861
Vachellia	*farnesiana*	CANB 615722	AF523115, AF195688, AF195669
Vachellia	*pennatula*	DS16053	DQ371878, DQ371855
Chloroleucon	*mangense*	CANB 615623	AF523072, AF522950, AF278517
Havardia	*pallens*	CANB 615547	AF274125, AF522955
Inga	*edulis*	MEL 2066677	AF523078, AF522957
Paraserianthes	*lopantha*	CANB 615550	AF274128, AF522962
Mimosa	*tenuiflora*	CANB 615541	AF274120, AF522943

A NEW SPECIES OF *PERITYLE* (ASTERACEAE) FROM SONORA, MEXICO

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ABSTRACT

Perityle reinana **sp. nov**., is described from the state of Sonora, Mexico where it is known only from the Sierra de Mazatan. It is a rayless taxon with affinities to *P. lemmonii.*

KEY WORDS: *Perityle*, Asteraceae, Sonora, Mexico, Sierra de Mazatan

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Routine identification of Mexican Asteraceae has revealed the following novelity:

Perityle reinana B. L. Turner, **sp. nov.**

P. lemmonii (A. Gray) Macbride similis sed differt foliis dentatis vel leniter lobatis (vs. profunde lobatis vel pinnatisectis), et bracteis involucralibus numerosioribus (ca. 21 vs. 8-15).

"**Tufted herbaceous perennial** on rock faces," 8-15 cm high. **Stems** densely pubescent with a vestiture of white cinereous hairs ca. 0.3 mm high. **Leaves** mostly alternate, 1.5-2.5 mm long, pubescent like the stems; petioles 1.0-1.5 mm long; blades flabellate, irregularly serrate, densely atomiferous-glandular above and below. **Pedicels** 2-4 cm long. **Involucres** campanulate, 5-7 mm high; bracts ca. 21, biseriate, linear-lanceolate. **Receptacle** glabrous, ca. 2 mm across. **Ray florets** absent. **Disk florets** 40-50; yellow, 3-4 mm long; tubes ca. 1 mm long, densely glandular-pubescent; lobes 5, ca. 0.8 mm long. **Achenes** ca 3.5 mm long, their faces black, sparsely upwardly appressed-pubescent to glabrous or nearly so; pappus of (1)2 setae 2-3 mm long, or commonly absent.

TYPE: **MEXICO. SONORA:** Mpio. de Ures, Canada el Vugo, Sierra de Mazatan, oak woodland on granite, 1383 m, 29 Apr 2004, *T. R. Van Devender et al. 2004-476* (with Reina, Sanchez E., Ferguson, Anderson & Johnson) (Holotype TEX; isotype ARIZ).

ADDITIONAL SPECIMEN EXAMINED: (same Sierra as above) "Ca. 0.5 km below Aguage in Canada del Alamo," 13 Mar 2005, *Reina et al. 2005-196* (ARIZ, TEX)

Perityle reinana belongs to the section Laphamia and relates to the eligulate *P. lemmonii,* as noted in the diagnosis. It also might be confused with the occasional rayless form of *P. gentryi*, the latter distinguished by its longer petioles, more regular dentate leaf margins, and longer (pilose) vestiture.

The following key to rayless members of Sect. Laphamia, this from my forthcoming treatment of *Perityle* for the Comps of Mexico (Phytologia Memoirs, in prep.) will serve to distinguish the taxon:

6. Leaves dentate or lacerately lobed, with 4-8 teeth or lobes to a side.. **(12)**
6. Leaves entire, merely dentate, or prominently 3-lobed, with 1-3 lobes to a side.. **(7)**

7. Leaves irregularly dentate to laciniately lobed.................. **(9)**
7. Leaves regularly dentate with mostly neat, acute teeth.......... **(8)**

8. Involucres 3.5-4.5 mm high; ne Chi, nw Coa......... ***P. castillonii***
8. Involucres 5-6 mm long; Son, w Chi...................... ***P. gentryi***

9 (7). Stems and leaves densely white-tomentose; Son.. ***P. vandevenderi***
9. Stems and leaves green or greenish, not white-tomentose.. **(10)**

10. Involucral bracts 8-12, linear-lanceolate, gradually tapering to a narrowly acute apex; ne Chi.. ***P. dissecta***

10. Involucral bracts 12-21, linear-oblanceolate, rather abruptly tapered to an acute or obtuse apex; nw Chi, Son..**(11)**

11. Involucral bracts 12-15; leaves deeply lobed or dissected.. ***P. lemmonii***
11. Involucral bracts ca. 21; leaves not dissected..........***P. reinana***

12(**6**). Leaves entire or merely dentate; pappus absent... ***P. angustifolia***
12. Leaves manifestly 3-lobed; pappus present......***P. coahuilensis***

According to its principal collector, the Sierra de Mazatan is an isolated 'sky island' mountain range about 80 km east of Hermosillo. The lower slopes on three sides support foothills thorn-scrub, while the northwestern slopes support desert-scrub. On the top of the range, the vegetation is open oak woodland in a grassland matrix on relatively flat, gneiss bedrock surfaces. Tropical species extend up the canyons and are locally present in the oak woodland at 1350-1400 m elevation.

The species is named for one of its collectors, Ana Lilia Reina. She received an undergraduate degree in Agricultural Sciences from the Univ. of Sonora in Hermosillo, and has been involved in ethnobotanical studies with the Seri and Mayo Indians. For the last nine years she has been working on floristic surveys in eastern Sonora and the Arizona-Sonora border region.

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LOEFLINGIA SQUARROSA (CARYOPHYLLACEAE): NEW TO LOUISIANA

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ABSTRACT

Loeflingia squarrosa is reported as new to Louisiana. A single station was discovered in the xeric sandylands of Caddo Parish in northwest Louisiana.

KEY WORDS: *Loeflingia*, Caryophyllaceae, Louisiana, Sandylands

While conducting rare plant surveys in Caddo Parish, Louisiana, *Loeflingia squarrosa* Nutt. was collected, apparently for the first time in the state. The material was not recognized in the field by the authors and was collected as an unknown. It was later identified as *L. squarrosa*. This species is not reported for Louisiana by Thomas & Allen (1996). It was only recently discovered in Arkansas, in Miller County, which borders Caddo Parish (Singhurst and Holmes 1999). This species is recorded for Cass and Marion Counties in adjacent Texas, and also in Shelby County, to the south, which borders DeSoto and Sabine parishes (Turner et al. 2003).

Loeflingia squarrosa is a characteristic species of xeric sandylands in the West Gulf Coastal Plain (MacRoberts et al. 2002). We collected *L. squarrosa* at a site known as Kendrick Road Sandylands (see MacRoberts & MacRoberts 1995 for description of vegetation) on 7 April 2004. This site includes small areas of thick, fire suppressed sandy woodlands, and considerable area of pastures, watermelon patches and roadsides on sandy soil. Despite the degraded condition, the site still supports many state-rare plants. The *Loeflingia* was collected in a sandy fallow field, with sparse vegetative cover.

Associate species included *Astragalus leptocarpus* Torr. & Gray, *A. soxmaniorum* Lundell, *Clematis reticulata* Walt., *Cnidoscolus texanus* (Muell.-Arg.) Small, *Evax candida* (Torr. & Gray) Gray, *Hymenopappus artemisiifolius* DC., *Lithospermum caroliniense* (Walt. ex J F. Gmel.) MacM., *Opuntia humifusa* (Raf.) Raf., and *Phacelia strictiflora* (Engelm. & Gray) Gray. When first collected, the site was for sale and access was gained by calling the seller from the field and receiving permission to go onto the site. A return visit on 1 April 2005 revealed that the parcel of land had been sold and the field had been disked in preparation for planting (most likely watermelons). Very little sandhill woodland habitat remains in Caddo Parish (personal observation; MacRoberts and MacRoberts 1995). However, a number of rare sandhill plants manage to persist in disturbed areas such as roadsides, power line and gas pipeline rights-of-way, pastures, and oil and gas fields. *Loeflingia squarrosa* is a small, easily-overlooked plant and could be present and overlooked in sandylands further south and east in Bienville, Natchitoches, Sabine, Vernon, and Winn parishes.

Specimen Cited: LOUISIANA. Caddo Parish: Kendrick Road Sandhills, N of Kendrick Rd. just E of jct. w/ Atlanta-Vivian Rd. (PR 119) and 1.5 mi W of jct. w/ LA 1; SW1/4 SW1/4 S11 T22N R16W; 325422N, 0935956W, 7 April 2004, Reid, Faulkner, & Jones 4855 (LSU).

ACKNOWLEDGMENTS

We appreciate Michael and Barbara MacRoberts for providing helpful comments on the manuscript and for providing distribution data for *Loeflingia squarrosa* in Texas. Barbara MacRoberts aided us with the initial determination of the specimen. We are also thankful to Theo Witsell of Arkansas Natural Heritage Commission for providing information on the status and distribution in Arkansas. We appreciate Tom Wendt of TEX-LL and Lee Luckeydoo of BRIT for checking their collections for Louisiana specimens of *Loeflingia squarrosa*.

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TWO NEW SPECIES OF *GROSVENORIA* FROM ECUADOR AND PERU (EUPATORIEAE: ASTERACEAE)

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ABSTRACT

Grosvenoria lopezii from northern Peru and *G. zamorensis* from southern Ecuador are described as new. A key is provided for the six species of the genus.

KEY WORDS: *Grosvenoria*, new species, Peru, Eupatorieae, Asteraceae.

The genus *Grosvenoria* was described by King and Robinson (1975) to include two Ecuadorian species, *G. hypargyra* (B.L. Rob.) R.M. King & H. Rob. and *G. rimbachii* (B.L. Rob.) R.M. King & H. Rob. and a species from northern Peru, *G. coelocaulis* (B.,L. Rob.) R.M. King & H. Rob. King and Robinson (1978) later described *G. campii* from Ecuador, and an older name has been recognized for *G. coelocaulis*, *G. jelskii* (Hieron.) R.M. King & H. Rob., Phytologia 76: 18 (1994)[1995], based on *Oliganthes jelskii* Hieron., Bot. Jahrb. Syst. 36: 461 (1905). The genus seems most distinctive among the Critoniinae genera of the Andes by the veins of the involucral bracts dissected into numerous longitudinal veins that appear as striations. The bristles of the pappus also tend to broaden and partially fuse near their bases. The style branches are not all as long or broad as originally described for the genus. All the species appear to have glandular dots on the undersurfaces of the leaves, but these are often poorly developed or covered with pubescence.

A review of accumulated material put aside during general identifications and efforts on the Flora of Ecuador have resulted in discovery of the following two additional new species.

Fig. 1. *Grosvenoria lopezii* H. Robinson, holotype, United States National Herbarium (US).

Grosvenoria lopezii H. Rob., **sp. nov.** Type: **Peru**. **Piura:** Huancabamba, Rumitana (Turmalina – Cuello del Indio), 2700 m, ladera boscosa, arbusto de capítulos blancos, 13 Sep 1981, *A. López M., A. Sagástegui, J. Mostacero & S. López 8853* (holotype US, isotypes F, HUT). (Fig. 1).

Ad Grosvenoriam hypargyram valde affinis sed in foliis minoribus apice brevioribus et floibus in capitulo ca. 20 distincta.

Shrubs 1 or more m tall, often with numerous branches from distal nodes; stems terete, covered with sordid whitish tomentum, not fistulose, internodes 1-2 cm long. Leaves opposite, petioles 0.2-0.4 cm long; blades ovate, mostly 2.0-3.8 cm long, 0.8-2.2 cm wide, base obtuse to short-acute, margins subserrulate with blunt teeth, apex short-acute, upper surface dark green, mostly glabrous with few scattered appressed hairs, lower surface densely pale-tomentose with appressed hairs; venation pinnate with two pairs of widely separated secondary veins ascending at ca. 35-40° angles. Inflorescence terminal, immediately subtended by scarcely reduced leaves, rounded corymbiform; branches ascending, pale tomentose; peduncles 0-3 mm long. Heads campanulate, 12-14 mm high, 4-7 mm wide; involucral bracts ca. 20, in ca. 4 series, 1.5-7.0 mm long, 1.0-2.5 mm wide, broadly ovate to oblong, apices rounded, outer surface striated with many longitudinal veins, often with long marginal hairs. Florets ca. 20 in a head; corollas white, narrowly funnelform, ca. 6 mm long, basal tube 2.0-2.5 mm long, throat ca. 2.5 mm long, lobes triangular, 0.7-0.9 mm long, with some glandular dots outside; anther collars ca. 0.35 mm long; thecae pale, ca. 2 mm long; apical appendage oblong-ovate, ca. 0.3 mm long, 0.2 mm wide; style branches not as long as the corolla, slightly broadened distally. Achenes ca. 4 mm long, with glandular dots sparse below, denser distally; carpopodium small, annuliform, symmetrical; pappus of ca. 30 whitish bristles, ca. 6.5 mm long, somewhat fused at base, not broadened distally. Pollen grains ca. 27µm in diam.

Grosvenoria lopezii is known only from the type collection. The species has more of the look of a *Cronquistianthus*, especially with the rather small leaves and the broadly rounded tips of the involucral

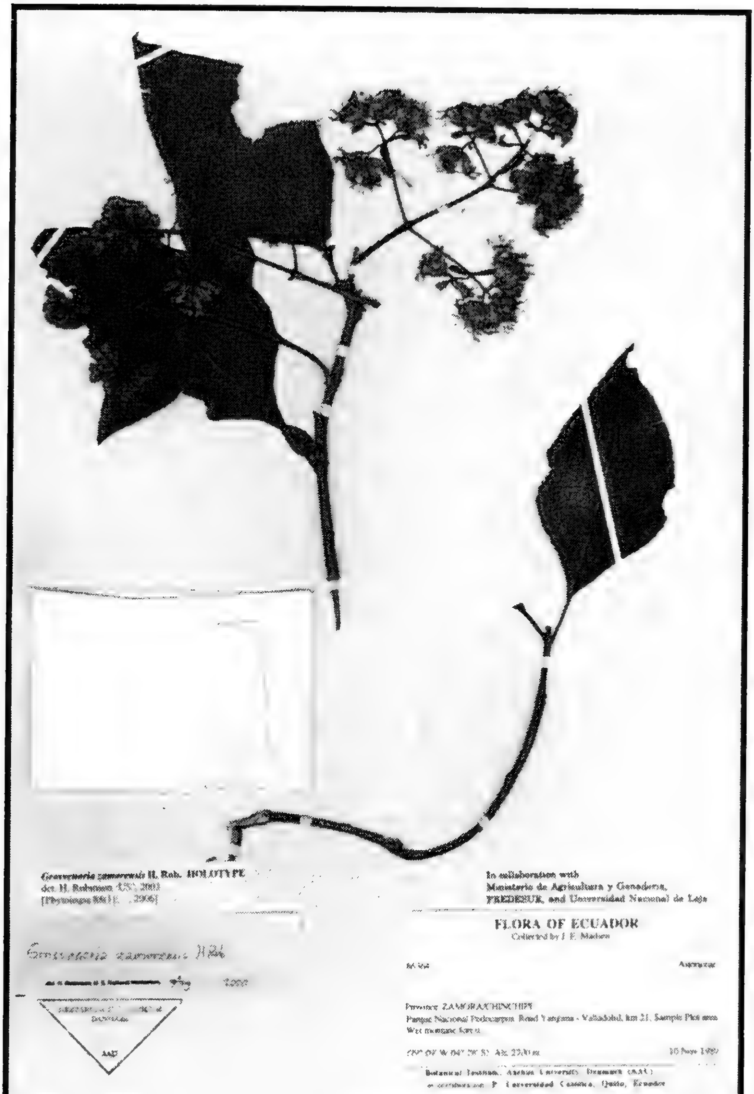

Fig. 2. *Grosvenoria zamorensis* H. Robinson, holotype, Botanical Institute, Aarhus University, Denmark (AAU).

bracts. Nevertheless, relationship to *Grosvenoria hypagyra* seems rather close, and the carpopodia are symmetrical. The hairs on the undersides of the leaves have the same weak hairs with flattened cells seen in the latter species, and the pappus bristles show the same kind of broadening and fusion at the base. Differences include the larger number of florets in the heads and shorter branches of the styles.

Grosvenoria zamorensis H. Rob., **sp. nov.** Type: **Ecuador. Zamora/Chinchipe:** Parque Nacional Podocarpus, road Yangana – Valladolid, km 21, sample plot area, wet montane forest, 04°28'S 79°09'W, 2700 m, 10 Nov 1989, *Madsen 86364* (holotype AAU, isotypes LOJA, QCNE). (Fig. 2).

Ab speciebus ceteris Grosvenorae in ramis et nervis secundariis basilaribus foliorum late patentibus et in inflorescentibus pyramidaliter paniculatis differt.

Shrubs ca. 1 m tall?, moderately branching; stems brownish, densely puberulous with minute often reddish hairs, not fistulose; internodes mostly 2-3 cm long. Leaves opposite, petioles ca. 1.5 cm long; blades ovate, mostly 10-12 cm long, 5-6 cm wide, base and apex short-acuminate, margins beyond lower 1/3 serrulate with rather remote denticulations, upper surface minutely hispidulous, lower surface minutely puberulous mostly on veins and veinlets, with small glandular dots; venation pinnate, with lowest 2 or 3 secondary pairs closer and weaker and spreading ca. 80° angles, upper 3 or 4 secondary pairs more widely separated, longer and arched. Inflorescence pyramidal, with branches and branchlets spreading at 75-90° angles, puberulous with reddish hairs; peduncles 0-2 mm long. Heads ca. 8 mm high, 3-4 mm wide; involucral bracts ca. 20, in ca. 4 series, 1.5-4.0 mm long, 0.8-1.3 mm wide, all acute, margins minutely fimbriate, outside reddish on exposed parts, outer bracts puberulous, with numerous longitudinal veins; inner bracts somewhat deciduous. Florets ca. 9 in a head; corollas reddish lavender, ca. 6 mm long, glabrous, basal tube ca. 2.5 mm long, throat ca. 2.5 mm long, lobes ca. 1 mm long, 0.5 mm wide, with few minute hairs outside. Achenes ca. 1.5 mm long, with few glandular hairs distally; pappus bristles ca. 35, ca. 5.5 mm long,

crowded at base, distally more tenuous, none obviously widened at tip. Pollen grains ca. 25 µm in diam.

Grosvenoria zamorensis is presently known only from the type specimen, collected in southern Ecuador at 2700 m in wet montane forest. The species seems most unusual in the genus by the pyramidal inflorescence with widely spreading branches, and by the smaller, spreading, lower, secondary veins of the leaf blades that are not parallel to the leaf margin. The leaves differ from others in the genus by being hispidulous or puberulous, neither glabrous nor tomentose.

The six species of *Grosvenoria* can be distinguished by the following key:

1a. Lower secondary veins of leaf blade spreading at 80-90° angles, directed toward leaf margin; inflorescence pyramidal with branches and branchlets spreading at 80-90° angles; involucral bracts acute. ***G. zamorensis***
1b. Lower secondary veins of leaf blade ascending, mostly subparallel with lower margins of blade; inflorescence corymbiform with branches usually ascending at 35-45° angles; involucral bracts mostly blunt or rounded at tip. 2

2a. Lower surface of leaf blade glabrous or sparsely pubescent. 3
2b. Lower surface of leaf blade densely covered with appressed tomentum. 4

3a. Stems partially fistulose. ***G. jelskii***
3b. Stems not fistulose. ***G. campii***.

4a. Leaf blades mostly 2.5-3.5 cm long, with apices short-acute; ca. 20 florets in each head. ***G. lopezii***
4b. Leaf blades mostly 5-14 cm long, with apices narrowly acute to acuminate; 8-10 florets in a head. 5

5a. Corollas reddish; stems usually with many flexuous lateral brnches; pubescence on leaf undersurface densely overlapping in centers of areoles. ***G. hypargyra***

5b. Corollas whitish; stems without numerous flexuous lateral branches from successive nodes. ***G. rimbachii***

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MIKANIA URCUENSIS, A NEW SPECIES FROM ECUADOR (EUPATORIEAE: ASTERACEAE)

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ABSTRACT

Mikania urcuensis is described as new from the Province of Napo in Ecuador.

KEY WORDS: *Mikania*, Eupatorieae, Ecuador. new species.

A major effort in the last decade has resulted in submission of a treatment of the tribe Eupatorieae for the Flora of Ecuador. The genus *Mikania* in that treatment was prepared by the present authors with recognition of 59 species for the country. Fifteen of these were described as new and one previous herbarium name was validated in preparation for the treatment (Robinson & Holmes 2002). Since that time, material has continued to be examined and additions to the flora have been found. These include an undescribed species from the Province of Napo described here to make it available for the revised flora manuscript. The present total of species recognized from Ecuador is 61.

Mikania urcuensis H. Rob. & W.C. Holmes, **sp. nov.** TYPE: Ecuador. Napo: Slopes of Guagra Urcu, on the loma above upper Río Borja, SE exposed montane forest, scandent, inflorescence white, 00°28'S, 77°44'W, 2600 m, 25 Sep 1980, *L.B. Holm-Nielsen, J. Jaramillo, F. Coello & E. Asanza 26986* (holotype US, isotypes AAU, QCA).

A Mikaniam bogotensis in ramis inflorescentis spicato-racemosis et in limbis corollarum salverformibus superficialiter simila sed in nodis non disciferis in laminis foliorum subglabris base non truncatis vel cordatis in bracteis involucri acutis et in lobis corollarum interne non papilliferis distincta.

Vines with sparingly branched, slender, flexuous stems; internodes often 9-12 cm long, terete, striate, densely puberulous with minute worm-like hairs, narrowly fistulose; nodes without discs, with only a tranverse ridge between leaves. Leaves opposite, petioles 0.5-1.5 cm long, densely puberulous with stout short hairs; blade ovate, mostly 33.0-8.5 cm long, 1.5-3.5 cm wide, base broadly obtuse to rounded, margins entire, apex acute, surfaces nearly concolorous, upper surface glabrous and smooth, with main veins minutely puberulous, veinlets prominulous, glandular dots sparse, obscure, lower surface dull, with more numerous, minute glandular dots, with few minute hairs mostly on veins; venation with two pairs of subparallel, ascending, arching secondary veins from 1-5 mm and 5-15 mm above base of blade. Inflorescences in pairs from axils of leaves, pyramidally thyrsoid with spiciform branches, a few small foliiform bracts at lower branches 7-15 mm long, distal bracteoles narrowly subulate, 3-7 mm long; with heads 7-17 on a branch, in spiciform or racemose groups, 1 erect and terminal, others spreading at 90° angles, mostly separated by 3-5 mm, sessile to subsessile; peduncles 1-2 mm long. Heads ca. 5 mm high, 2-3 mm wide; subinvolucral bract at base of peduncle, subulate, ca. 1.5 mm long, involucral bracts 4, narrowly oblong, ca. 4 mm long, 0.8 mm wide, apex short-acute, base narrow, gibbous, minutely puberulous, outside mostly glabrous. Florets 4; corollas white, 3.3-3.5 mm long, glabrous, basal tube slender, tubular, ca. 2 mm long, limb ca, l.3 mm long, salverform, throat ca. 0.3 mm, lobes oblong-ovate, ca. 0.8 mm long, smooth on both surfaces; anther collar ca. 0.3 mm long; thecae ca. 0.8 mm long; apical appendage ca. 0.2 mm long, 1.7 mm wide; style base plain; style branches mamillose, more strongly at base. Achenes prismatic, 5-angled, 1.6-1.9 mm long, mostly glabrous, with some slender unseriate hairs in distal 1/5; pappus of ca. 35 slender white bristles, ca. 3 mm long, broadened distally. Pollen grains ca. 18 µm in diam.

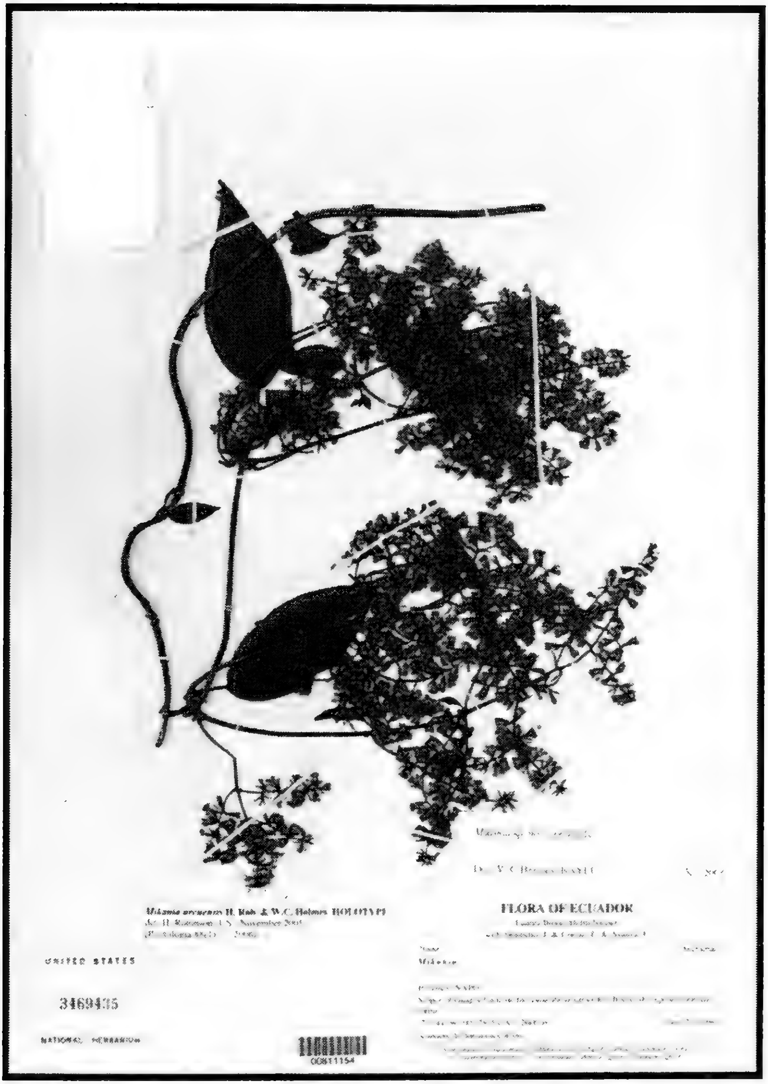

Fig.1. *Mikania urcuensis* H.Robinson & W.C. Holmes, holotype, United States National Herbarium (US).

Paratype: Ecuador. Napo: Guagra Urcu, the pass between Río Borja and Río Suno, montane forest, scandent, flowers white, 00°28'S, 77°43'W, 2700 m, 27 Sep 1980, *L.B. Holm-Nielsen, J. Jaramillo, F. Coello & E. Asanza 27309* (AAU, QCA, US).

Mikania urcuensis is presently known only from the type and 1 paratype specimen. It is named for the locality in which it was found. There is a superficial resemblance to *Mikania bogotensis* Benth. because of the racemose/spiciform inflorescence branches and the salverform limb of the corolla. However, the lack of nodal discs on the stem, the nearly glabrous leaves without truncate or cordate bases, and the lack of mamillae inside the limb of the corolla make close relationship very doubtful. The greater separation of the heads on the branches also distinguishes the species. The leaves show some resemblance to those of another group with racemose/spiciform inflorescence branches, the *M. houstoniana* (L.) B.L. Rob. group, but the leaves of the new species lack the attenuate tips and the highly ordered tranverse tertiary venation of the latter group, and the salverform limb of the corolla is totally different.

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A NEW COMBINATION IN *BRYUM* (MUSCI: BRYACEAE)

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ABSTRACT

A new combination in *Bryum* is provided for the Andean *Anomobryum worthleyi*.

KEY WORDS: *Anomobryum, Bryum,* new combination.

Recent papers by John R. Spence (Spence and Ramsay 2002; Spence 2005a, b) mention problems concerning the typification of the genus *Bryum Hedw.*, and the resulting effects on the status of the genus *Anomobryum* Schimp. The papers accept the fact that *Anomobryum* is congeneric with the common *Bryum argenteum* Hedw. Unfortunately for the the generic status of *Anomobryum, Bryum argenteum* had been chosen by E.G. Britton as lectotype of the genus *Bryum* (Britton 1918). Such lectotypifications made by staff of the New York Botanical Garden during the early 20th Century were often arbitrary and sometimes so buried in the literature as to be easily overlooked. As such they were often later rejected even without resort to any committee. However, the selections were not always unreasonable, and such lectotypifications were not always rejected. The Britton lectotypification had been widely accepted, and was cited in Index Muscorum (Van der Wijk, Margadant and Florschütz 1959). It is only recently that the full possible consequences of the Britton lectotypification have become apparent, for *Anomobryum* and for other elements traditionally placed in *Bryum*. Spence and Ramsay (1999) proposed conservation of the name *Bryum* with another type, but as indicated by Spence (2005), this has been rejected.

The consequences of the typification of *Bryum* by *B. argenteum* are most noticeable in many other parts of what has been called *Bryum*,

with the resurrection of such genera as *Ptychostomum* Hornsch., the description of new genera such as *Gemmabryum* J.R. Spence and H.P. Ramsay, *Ochiobryum* J.R. Spence and H.P. Ramsay, *Plagiobryoides* J.R. Spence, and the elevation of *Leptostomopsis* (Mull.Hal.) J.R. Spence & H.P. Ramsay (see Spence 2005a, b). These are added to the earlier new genus *Rosulobryum* J.R. Spence (1996).

The consequences of the synonymy of *Anomobryum* with *Bryum* are not as great, since the number of species of *Anomobryum* is limited, and many of those species have preexisting combinations in a broader concept of *Bryum* (Allen 2002; Ochi 1980). One South American species where a combination is required is treated below.

Bryum worthleyi (H. Rob.) H. Rob., **comb. nov.** basionym: *Anomobryum worthleyi* H. Rob., Bryologist 70: 320 (1967). Bolivia, Peru.

This is the same species treated by Ochi (1980) as *Bryum albo-imbricatum* Ochi, nom. nov. for *Bryum albidum* Broth. in Herz.., Biblioth. Bot. 87: 81 (1916), *hom. Illeg.*, non P. Beauv. 1805; nec Copp. 1911. When Ochi (1980) provided the nom. nov. he was evidently unaware of the already existing name *Anomobryum worthleyi* (Robinson 1967) which had priority.

The name of the species honors the late Elmer Worthley, who collected the type near Machu Picchu, Peru in 1962.

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BIOGEOGRAPHICAL OBSERVATIONS ON LOUISIANA AND TEXAS RARE AND ENDEMIC PLANTS

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ABSTRACT

Using state rare and endemic plant lists, we document the North American distribution of Louisiana and Texas rare plants and the distribution of Texas endemic plants. Because the Louisiana and Texas rare plant lists have been developed using different criteria, the North American distribution maps of each are distinctly different. Texas endemics are concentrated in the center of the state.

KEY WORDS: Louisiana, Texas, rare plants, endemic plants.

Because of conservation concerns, state agencies such as the Natural Heritage programs, Parks and Wildlife departments, and The Nature Conservancy produce rare and endemic plant lists. However, listed plants generally have not been subjected to biogeographical analysis. In this paper, we examine the Texas rare and endemic plant lists and the Louisiana rare plant list inorder to place listed taxa in a broader biogeographical context. We do not question what is on the lists, nor do we question taxonomic status. We simply use the lists as data.

THE LISTS

The Louisiana rare plant list is produced by the Louisiana Natural Heritage Program. The 2004 edition consists of 368 taxa (Reid 2004) and includes both globally rare (G1-G3/T1-T3) and locally rare taxa (S1-S3) that might not be rare elsewhere but that are rare in Louisiana. The Texas rare plant list is produced by the Texas Parks and Wildlife Department and The Nature Conservancy of Texas. The 2004 edition

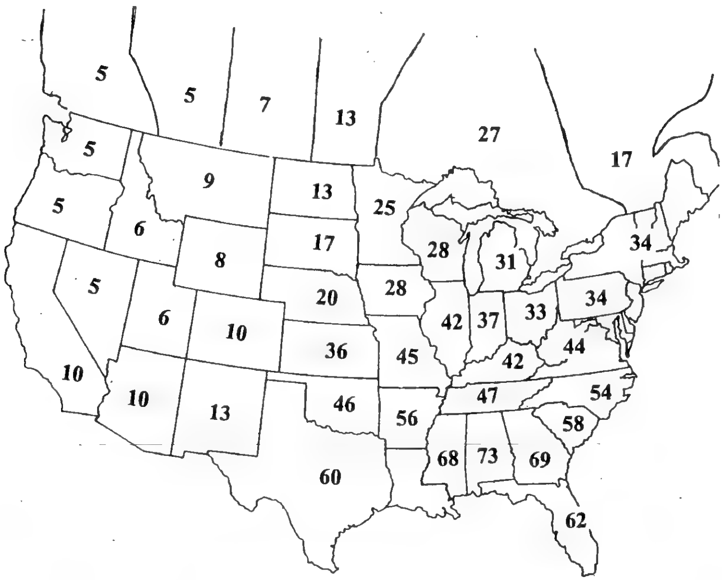

Figure 1. North American distribution (as percentage of total) of taxa on the Louisiana rare plant list.

consists of 454 taxa and includes only G3/T3 and rarer plant taxa (Carr 2004, Poole et al. 2004). The Texas endemic list is produced by the Nature Conservancy of Texas; the 2002 edition consists of 271 taxa (Carr 2002). Sixty-six percent of Texas endemics are listed as rare in Texas, the remaining 34% are G4 or G5 and thus do not classify for inclusion on the rare list (Appendix 1 explains G, S, and T ranks).

METHODS

1. Using Kartesz and Meacham (1999), we determined the North American distribution of taxa on the Louisiana rare plant list.

2. Using Carr (2004) and Kartesz and Meacham (1999), we determined the North American distribution of taxa on the Texas rare plant list.

3. Using Carr (2004) and Turner et al. (2003), we plotted the distribution of Texas endemics by county.

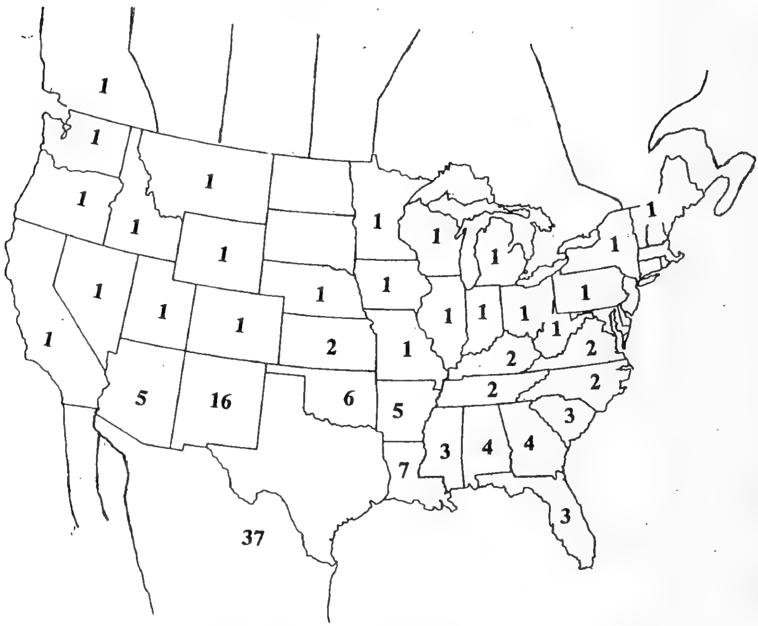

Figure 2. North American distribution (as percentage of total) of taxa on the Texas rare plant list.

RESULTS

Figure 1 shows the North American distribution (as percentage) of taxa on the Louisiana rare plant list. Figure 2 shows the North American distribution (as percentage) of taxa on the Texas rare plant list. Figure 3 shows the distribution of Texas endemics by counties.

DISCUSSION

As Figures 1 and 2 show, there are marked differences between the North American distribution of Louisiana and Texas rare plants. Of the 454 taxa on the Texas rare plant list, 40% are endemics and the remaining 60% occur in one or more other states or countries: 37% in Mexico, 16% in New Mexico, and so on. Of the 368 taxa on the Louisiana rare plant list (Louisiana has few endemics), 60% occur in

Figure 3. Number of Texas endemics by county. No number means no endemics.

Texas, 68% in Mississippi, 56% in Arkansas, and so on. The North American distribution of Louisiana rare plants is much wider than that of Texas rare plants. This is, of course, because 82% of the Louisiana list are G4-G5/S1-S3 and about 90% of all taxa on this list are at the edge of their range; only about 20% of Texas taxa are edge of range.

The biogeographic pattern of Texas endemics shows the highest incidence of endemism in the central portion of the state, including the Texas Coastal Bend region and along the Mexican border, with virtually no endemics occurring along the northern, western, and eastern borders (this pattern is also evident in the TAMU [2005] "Texas Endemism" map). This distribution pattern is interesting given

that we know that there are about 100 endemics in the West Gulf Coastal Plain (MacRoberts et al. 2002). Only 28% of these appear on the Texas endemic list. The remaining 72% have a two or more state range: southeastern Oklahoma, southern Arkansas, and/or western Louisiana. The high incidence of Texas endemics along the Mexican border is probably explained, a least in part, by the fact that northern Mexico has not been as thoroughly collected as southern Texas, and many seeming Texas endemics will be found to occur in Mexico as well.

The Texas endemic list is largely artificial and artifactual, or as Carr (2002:1) has written, the list "has no biological significance, since political boundaries do not correspond to biotic and abiotic forces that effect plant distribution." Aside from the Gulf of Mexico, there is no natural ecological boundary between Texas and adjacent regions. The Red, Rio Grande, and Sabine rivers present little or no obstacle to plant dispersal. Further, while Texas is made up of many ecoregions, none is restricted to Texas with the possible exception of the Edwards Plateau and the Coastal Bend depending on how these regions are defined. Does the Edwards Plateau include the Stockton Plateau, does it cross the Rio Grande and thus is not restricted to Texas, or does it only extend to the Pecos River and not enter Mexico? And is there any ecological uniqueness to the Coastal Bend?

While the Edwards Plateau is often said to be a region of high plant endemism, its endemism has not been thoroughly studied (Amos and Rowell 1988). However, on the basis of a preliminary survey using Carr (2002) and Turner et al. (2003) and a map of the Edwards Plateau that excludes the Stockton Plateau and Mexico, we found that the region had 28 endemics (e.g., *Carex edwardsiana, Tradescantia pedicellata*) and 23 near-endemics (e.g., *Euphorbia roemeriana, Galactia texana*) (see MacRoberts et al. 2002, Zollner et al. 2005 for terminology and studies of local endemism), or about two percent of the native flora. But all Texas endemics occurring in the Edwards Plateau are not endemic to that region. Kerr County, in the center of the Edwards Plateau, illustrates this. It has 52 Texas endemics of which 35 (67%) are Edwards Plateau endemics or near-endemics while 17 (32%) are not (e.g., *Lesquerella densiflora*, *Salvia engelmannii*). This

situation also characterizes the Coastal Bend region.

Clearly, studies of endemism in all regions of Texas are indicated, but these should be based on ecologically meaningful boundaries.

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APPENDIX 1. Each taxon is assigned a global rank and a state rank. Global ranks are given by NatureServe; state ranks by each state's Natural Heritage Program. G1 = Critically imperiled globally, 5 or fewer known extant populations. G2 = Imperiled globally, 6 to 20 known extant populations. G3 = Either very rare and local throughout its range or found locally (even abundantly at some locations) in restricted range (e.g., a single physiographic region) or because of other factors making it vulnerable to extinction throughout its range, 21-100 known extant populations. G4 = Secure globally although it may be rare on periphery of range, 101-1000 extant populations. G5 = Demonstrably secure globally although it may be rare on periphery of range, 1001 or more known extant populations. T ranks follow the same pattern except they refer to subspecies and varieties. S ranks refer to state ranks and follow the same pattern as G and T ranks but refer to taxa within states. Thus, a taxon could be G5T5S2 (as is *Houstonia purpurea* var. *calycosa* in Louisiana), meaning that the taxon is secure globally but rare locally.

A NEW SPECIES OF *VERBESINA* (ASTERACEAE: HELIANTHEAE) FROM GUERRERO, MEXICO

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ABSTRACT

A collection by Breedlove from near Puerto El Gallo, Guerrero, Mexico is described as **Verbesina elgalloana** B. L. Turner, **sp. nov.** Its relationship appears to be with *V. gracilipes* and cohorts.

KEY WORDS: *Verbesina*, Asteraceae, Mexico, Guerrero

Preparation of a treatment of the genus *Verbesina* for the Comps of Mexico (cf. Turner 1997, Phytologia Memoirs 11: 1) has prompted description of the following:

VERBESINA ELGALLOANA B. L. Turner, **sp. nov.**

V. gracilipi B. L. Rob. similis sed differt caulibus appressi-hispidis (vs longi-hirsutis), pedunculis ultimis brevioribus (1-3 cm longis vs. plerumque 4-10 cm), et foliis majoribus fere glabris (vs. inferne dense pubescentibus).

Shrubs to 2 m high. Stems 5-sided, minutely appressed-hispid, the angles with corky wings. **Leaves** thin, alternate; petioles 2-4 mm long, the blades lanceolate-ovate, pinnately nerved, 11-14 cm long, 3-5 cm wide, sparsely hispidulous beneath, especially along the major veins, the margins remotely serrulate. **Capitulescense** terminal, 5-headed, subumbellate, the ultimate peduncles finely appressed-strigose, 1-3 cm long. Involucres 5-6 mm high, ca 10 mm across, the bracts in 3-4 subequal series, the outermost loose and subfoliose. **Receptacle** conical, ca 3 mm high, 3 mm across; bracts spatulate, ca 3 mm long,

abruptly acute at the apex. **Achenes** (immature), flattened, ca 2 mm long, the pappus of two rigid awns ca 1.6 mm long.

TYPE: **MEXICO. GUERRERO**: "W of Puerto El Gallo along road to Toro Muerto," along ridge with *Pinus, Quercus, Clethra* and *Cleyera,* 2530 m, 9 Oct 1986, *Breedlove & Almeda 65043* (Holotype: TEX; isotypes CAS).

Verbesina is perhaps the most speciose genus of the tribe Heliantheae in North America. The present novelty brings to 142 the number of species to be recognized by me in my forthcoming treatment of the group for Mexico. Numerous additional novelties are to be anticipated.

The species name is derived from the village of Puerto El Gallo, Guerrero.

ACKNOWLEDGMENTS

I am grateful to Dr. Guy Nesom of BRIT for the Latin diagnosis, and to him and Mike Powell of SRSC for reviewing the manuscript.

A NEW SPECIES OF *TETRACHYRON* (ASTERACEAE: HELIANTHEAE) FROM MEXICO

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ABSTRACT

A new species, **Tetrachyron chimalapanum** B.L. Turner **sp. nov**., is described from the more montane regions of eastern Mexico (Veracruz to Oaxaca). The present novelty brings to eight the number of species to be recognized in my forthcoming treatment of the genus for Mexico. A key to the eight taxa concerned is provided

KEY WORDS: Asteraceae, *Tetrachyron*, Mexico

Wussow and Urbatsch (1979) provided a systematic study of *Tetrachyron* in which five species were recognized. The present author subsequently added two additional species (*T. oaxacanum* and *T. torresii*). The following novelty brings to eight the number of species to be recognized in the genus for my forthcoming treatment of the Comps of Mexico (tribe Heliantheae, in prep.).

TETRACHYRON CHIMALAPANUM B.L. Turner, **sp. nov.**

Tetrachyron orizabaense Klatt similis sed foliiis serratis in sicco nigrescentibus et caulibus perspicue villosis (vs. glabris vel glabresentibus) differt.

Shrubs 0.5-1.0 m high. Leaves opposite, 5-12 cm long, 2-4 cm wide (including petioles); petioles 4-20 mm long; blades ovate-lanceolate, markedly venose beneath and hirsute along the principal veins, their margins decidedly serrate. Capitulescence a terminal corymbose panicle of 10-50 heads, the ultimate peduncles bracteate, 1-10 mm long, variously hirsute. Involucres campanulate, ca. 5 mm high, 5-6 mm wide; bracts 3-4 seriate, lanceolate, imbricate, glabrous, their apices obtuse or rounded, the outer most series 1-4, mostly

Fig. 1. Distribution of *Tetrachyron chimalapanum*.

reflexed. Receptacle conical, ca. 1 mm across, 2 mm high, paleate. Ray florets 8-11, pistillate; ligules yellow, 3-7 mm long, 2-3 mm wide, 4-5 nervate. Disk florets 20-40 per head; corollas yellow, glabrous, 5-lobed, ca. 3 mm long, the tube ca. 1 mm long. Achenes 3-4 sided, ca. 2.5 mm long, sparsely pubescent; pappus of 4 linear scales ca. 1.5 mm long, interspersed among these 4-8 shorter scales ca. 0.5 mm long.

TYPE: **MEXICO. OAXACA**: Mpio. San Miguel Chimalapa, ca. 3-4 km al O del paraje palmero " El Gringo," al N del cerro Tres Picos, 1550 m, 26 Aug 1986, *Tom Wendt, M. Ishiki I., & Solomon Maya J. 5448* (Holotype: TEX; isotype: CHAPA).

ADDITIONAL SPECIMENS EXAMINED: **MEXICO. OAXACA**: Mpio. San Miguel Chimalapa, Cerro Baul, ca. 23 km en linas recta al N de San Pedro Tapanatepec, 2050 m, 18 Jul 1985, Wendt et al. 4984 (TEX). **VERACRUZ:** Mpio Calcahualco, "cerca de Totosinapa, faldas

del Pico de Orizaba," 2100 m, 2 Jul 1985, M. Chazaro & M. Leach 3466 (TEX).

Tetrachyron chimalapanum is closely related to *T. orizabaensis* but clearly differs as noted in the above diagnosis. Indeed, it apparently occurs near or with the latter, but maintains its distinctive characteristics. Wussow and Urbatsch (1979) did not account for the taxon concerned in their treatment of the genus nor, to my knowledge, did they examine any of the specimens cited herein.

The species is named for the Mpio. Chimalapa, Oaxaca (Fig. 1) from whence first collected.

The following key will distinguish among the eight species to be recognized in my forthcoming treatment of the genus for Mexico.

1. Heads mostly solitary; involucral bracts densely white-tomentose..*T. grayi*

1. Heads several or more in terminal clusters; involucral bracts glabrous to puberulent...............................(2)

2. Blades broad, 2-3 times as long as wide, bi-colored, densely soft-pubescent beneath; Queretero and Hidalgo..*T. discolor*
2. Blades 3-7 times as long as wide, glabrous to softly puberulous beneath..................................(3)

3. Leaves linear to linear-oblanceolate, 2-8 mm wide........*T. brandegei*
3. Leaves ovate to elliptical, 12-50 mm wide....................................(4)

4. Leaves perfoliate, an interpetiolar flange or disk present..*T. manicatum*
4. Leaves not perfoliate, interpetiolar flanges absent..........................(5)

5. Leaves ovate-deltoid, the blades widest at the base or nearly so; involucres 3-4 mm high; se Oaxaca.........*T. torresii*

5. Leaves ovate to ovate-lanceolate, the blades
   widest well above the base; involucres 4.5-8.0 mm high.................(6)

6. Involucres 6-8 mm high.................... ....*T. websteri*
6. Involucres 4.5-5.5 mm high; southern Mexico...............................(7)

7. Leaves entire or nearly so, drying pallid-green;
   petioles and
   stems glabrous or nearly so..*T. orizabaense*
7. Leaves decidedly serrate, drying blackish;
   petioles and stems decidedly villous........................*T. chimalapanum*

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